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ABSTRACT

Energy is a problem affecting all individuals. To help today's students understand the problem and become realistic decision-makers, materials have been developed by the Sunny Side Up (in Mathematics) program to introduce energy concepts into the mathematics curriculum. Objectives of the program are to: (1) provide highly effective practice in some basic concepts and skills in mathematics, with emphasis on real-life word problems; (2) provide students with skills to conserve natural resources for themselves and future generations; and (3) provide students with energy facts (focusing on solar energy) while increasing mathematical skills. The materials (including puzzles, projects, problems, and various activities) are designed to provide flexibility while fostering such mathematical skills as problem solving, computation with whole and rational numbers, graphing, and meter reading. Unit 1 focuses on whole numbers, fractions, decimals, and percents. Unit 2 contains various energy activities, with mathematical skills needed listed at the beginning of each section. Unit 3 uses energy facts/concepts to foster graphing skills. Unit 4 contains activities designed for independent study and enrichment. (Author/JN)

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SUNNY SIDE UP IN MATHEMATICS

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Many people are responsible for Sunny Side Up. Seminole County teachers worked long and hard to produce the curriculum in Language Arts, Mathematics, Science, and Social Studies. Carol Gentry provided the abundance of excellent illustrations and Eileen Dunn supervised typing and retyping the manuscripts. But there are many others who helped. Dick Tillis and Jim Phillips from Florida's Office of Environmental Education provided the funding and made many valuable suggestions during the project. Rosalyn Tillis generously supplied an abundance of publications from the Governor's Energy Office.

We borrowed ideas, activities and even some illustrations from other energy education materials including:

Solar Energy Project developed for the U. S. Department of Energy by the New York State Education Department, Bureau of Science Education;

Solar Energy I and II from the American Museum of Science and Energy, Oak Ridge Associated Universities;

Energy and My Environment by Matt Brennan, published by the Florida's Governor's Energy Office, and;

Solar '80's by David LaHart which is published by the Florida Solar Energy Center. Copyrighted material was included only when proper permission could be obtained.

Sunny Side Up is symbolized by Sunny Solar, an all knowing critter who has not lost the common touch. Notice the bad tennis shoes! Professor, hard hat, adventurer or politician, Sunny is always helping us along the path to energy knowledge. We hope you enjoy Sunny while you are learning about energy.

David E. LaHart
Cape Canaveral

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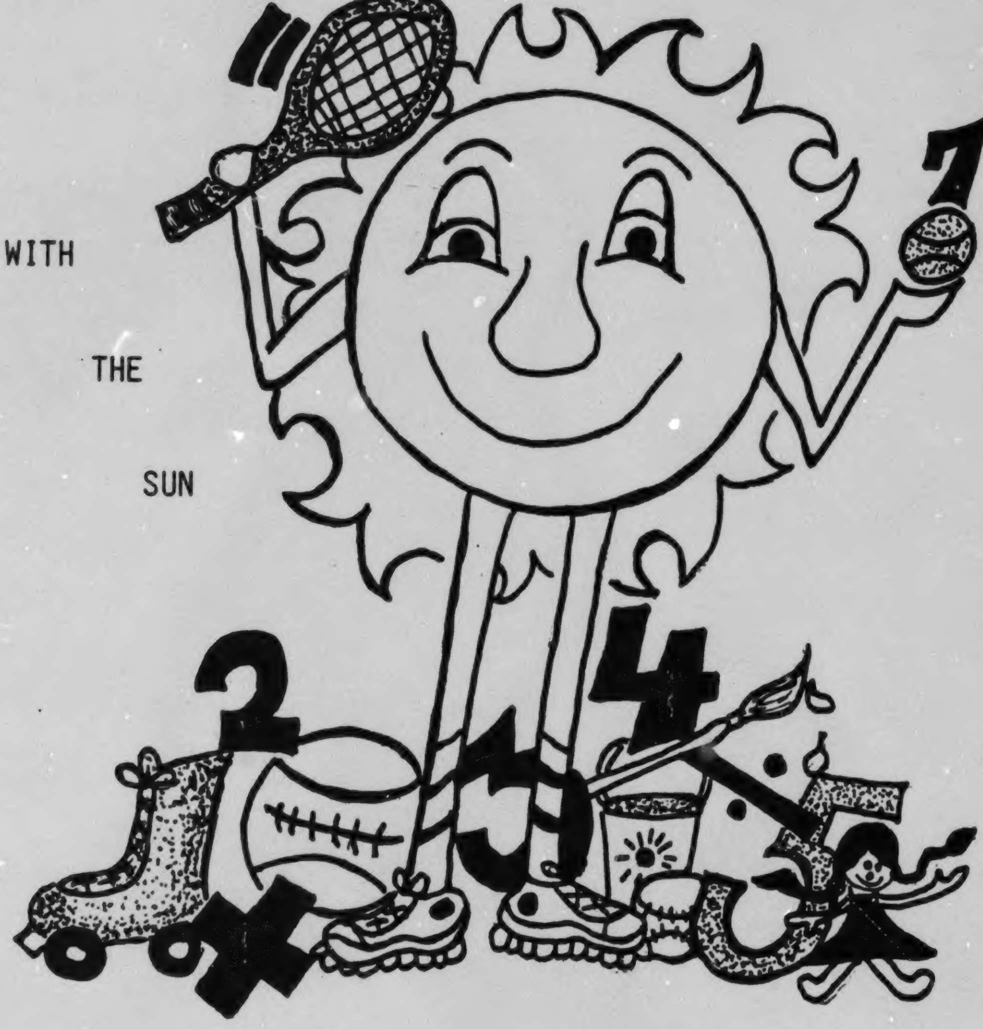
UNIT ONE

FUN WITH THE SUN



Teachers are encouraged to duplicate the activities in this section and distribute them as classwork or homework.

UNIT I

WHOLE NUMBERS

Sunny's Energy Line---------- I-1
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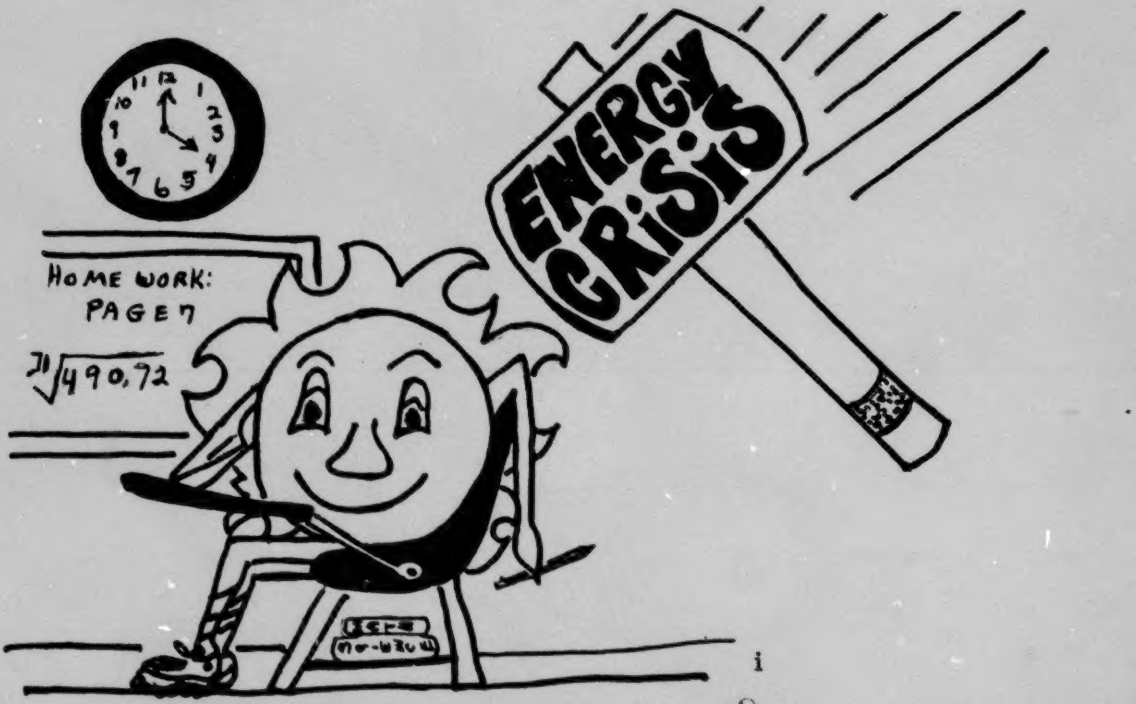
INTRODUCTION TO SUNNY'S MATH

I. Will You Change From Today's Energy Use Patterns? (Rationale)

Energy is a problem affecting all of us. Today's students are perhaps, the hardest hit by the energy crisis. They are tomorrow's consumers and at current consumption rates, there might not be enough of the resources to go around in the future. They are the ones that will be faced with the life style changes that will be required to conserve and stretch present resources. In order to help today's students understand the problem and hopefully for them to become realistic decision makers, these activities have been developed to introduce energy concepts into the mathematics curriculum.

Individuals can do two things to help. One is to conserve and the other is to develop new energy sources. About half of our energy is wasted. Do your students make the most of our energy resources? Individuals can use mathematics to measure the need for and use of energy. Our nation has become dependent on oil supplies from foreign nations for gasoline for cars, fuel for manufacturing materials, and for generating electricity. Working together, individuals can make a difference in the rate of consumption while alternative sources of energy are being developed.



The program objectives are:

1. To provide highly effective practice in some basic concepts and skills in mathematics, with emphasis placed on real-life word problems.
2. To provide students with the skills to conserve natural resources for themselves and future generations.
3. To provide students with energy facts while increasing mathematical skills.

The energy challenge involves people who have not learned how to use finite amounts of energy within a biologically sustainable limit. The problem is that seven percent of the world's population (us) use 33 percent of the world's energy. That is the problem. And the solution is not more energy.

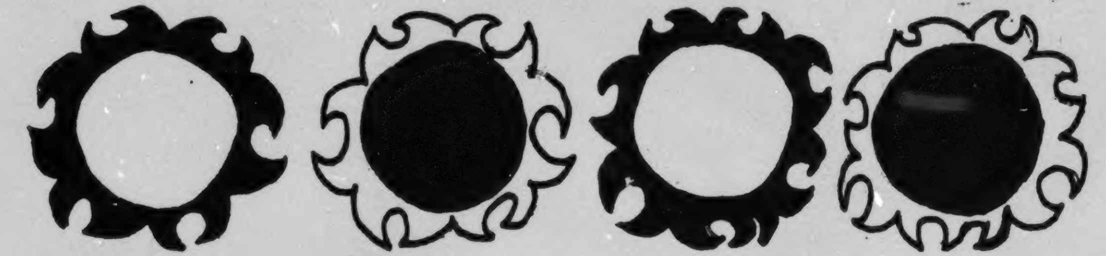
We live in a country that is doubling its population every 70 years; doubling its electrical consumption every 10 years. Understanding exponential growth is the key to understanding the energy challenge because just increasing the amount of energy cannot keep pace with the growth rate of our energy appetite.

Educators obviously play a key role in determining our future energy path. Preparing young people to make decisions has been a traditional goal of education, and energy decisions will have long-term effects. Mathematics teachers can do their part by incorporating this knowledge into their everyday teaching.

CONSERVE
IS
THE WORD?

Florida, the "Sunshine State," has abundant solar energy and significant population to use it. Fossil fuels, which produce 90 percent of Florida's energy, are becoming scarce while Florida's population is increasing.

Solar energy has implication for the long-term future of the United States. By teaching our young people its potential, teachers can be instrumental in helping with our nation's future.



II. How Can You Teach Solar Energy In A Middle School Math Class? (Goals and Objectives)

These materials are designed to provide the flexibility which any good teacher demands, yet provide the recurring energy theme which may well be essential if the lessons are to have any lasting impact on the student. Puzzles and games often provide a welcome relief from the concentration required by more comprehensive activities. Yet they also can provide opportunities for reviewing terms and concepts in new and provocative ways. Possible applications to solar energy are numerous. The materials include projects, puzzles, problems, and activities. Mathematics includes problem solving, computation, with whole numbers and rationals, graphing, and meter reading.

ENERGY ACTIVITIES: SUGGESTIONS FOR SCHOOLS*

- Ask the principal to declare Sun Day in the school as a special day devoted to solar energy studies, special programs, games, contests, presentations and exhibits.
- Survey the school library's energy books. Request the librarian to add books on energy conservation and solar power. Ask that these materials be put on display.
- Perform solar energy experiments in science classes using class-constructed materials.
- Construct solar collectors, window box heaters, cookers, stoves, etc. in shop classes. Design solar structures in drafting/architecture classes.
- Calculate the comparative costs of different energy strategies (solar, oil, nuclear, conservation) in math classes.
- Start an energy section in the school newspaper. Work with local newspapers, radio, etc. to make sure local Sun Day events are covered.
- Write or call the state energy/consumer office and report to the class about their energy programs. Do they provide consumer information on solar energy? Consumer protection programs? Energy education programs?
- Develop an energy presentation for the community that includes displays, shows, speeches, art work. Identify buildings in the community that waste energy, and offer possible conservation programs as solutions. Investigate building codes to see if solar energy is being encouraged or discouraged. If the latter, then consider possible changes.
- Set up a speakers bureau of solar energy experts.
- Stage a contest for designing Sun Day posters, songs, T-shirts. Think of other art projects. Make a sundial for the school.
- Design bulletin board displays concerning the sun and solar energy issues. Continually update the displays with "Energy Facts of the Week" brought in by different students.
- Conduct an energy audit of school buildings. Find out how energy can be conserved.
- Distribute an energy conservation checklist with energy-saving ideas for the home, and encourage students to work with their parents to make their homes energy efficient. Help install insulation, weatherstripping.
- Sponsor a festival of solar energy films and slideshows.

- Make field trips to solar buildings in the area. Photograph them, then organize a photo exhibit or produce a slideshow.
- Investigate local banks to find out what homeowner loans they offer for solar investment.
- Ride a bicycle or walk as often as possible to conserve fuel.

III. Are Your Sun Facts Clouded Over?
(Solar Information)

Most energy used by man is from the sun. Whether it be oil, gas, coal, water, or wind, it started with the sun. Heat from the sun causes air currents to create wind and waves; the decomposition under heat and pressure of plant and animal life produced oil, gas, and coal.

Energy from the sun also heats the ocean thereby evaporating countless tons of water which later return to earth as rain. Heated air causes currents to surge upward creating the winds which power sailing ships and windmills. Winds in excess of 100 miles per hour can destroy buildings, trees, and houses. We know this energy as tornados.

Today the sun is heating Florida at a rate of about 1,600 British Thermal Units (BTU) per square foot each hour. The average daily amount of heat available on a square foot is between 10,000 and 13,000 BTU. Most of this radiant energy is wasted. Green plant life is the main user of this energy. Man in turn uses plants for food, lumber, feed for cattle, etc.

Solar energy can be tapped in several ways. The two most common ways are passive and active. A passive system is used in homes to heat the houses in winter. Extra insulation is used in all surfaces and natural air flow, called convection, moves the heated air from a hothouse-like south facing wall to all parts of the house. Passive systems "do it naturally".

An active system uses collectors, which are mounted on south facing roofs, to heat water or air which is then pumped to the rooms in the house (Figure 1). Since no solar heat is collected at night or on very cloudy days, a storage container of rocks or water must be used to store heat for night time use.

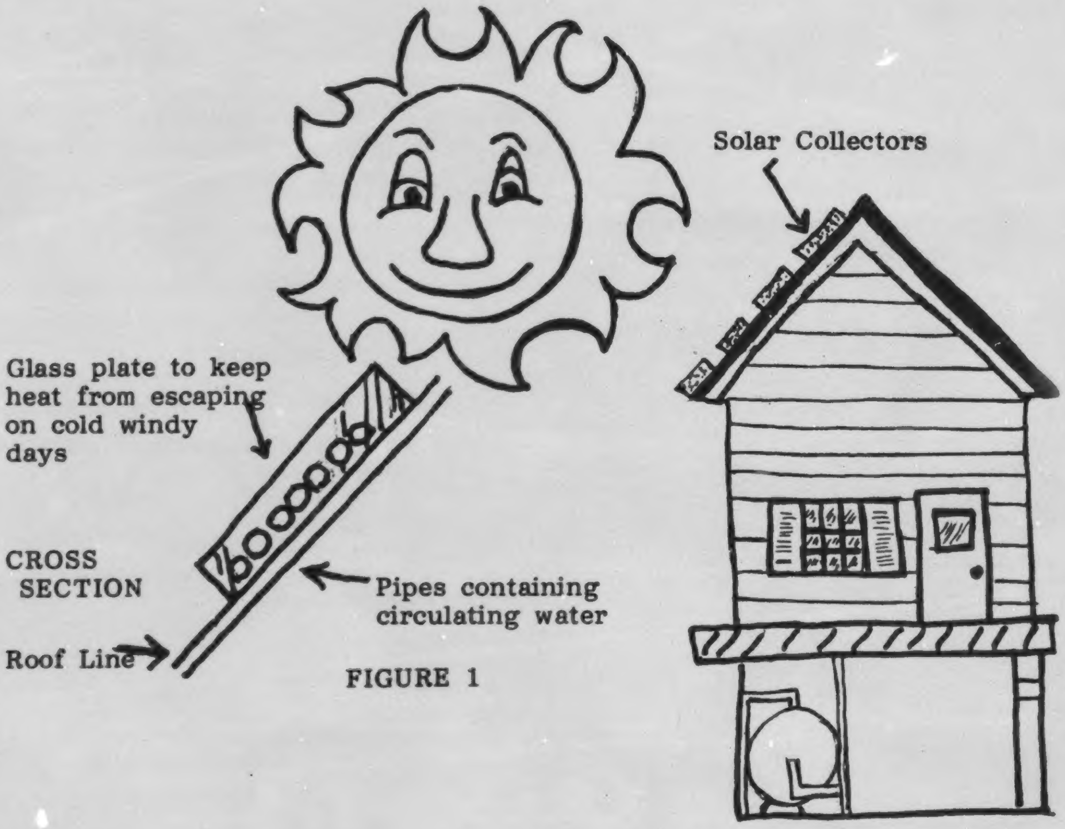
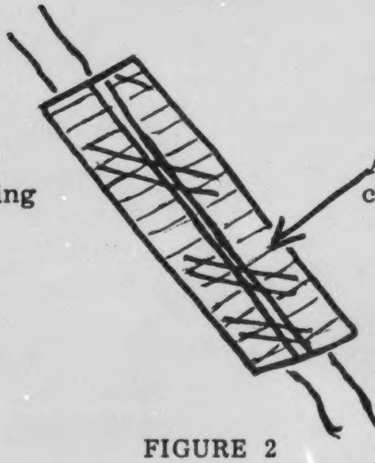

Solar Collectors
Glass plate to keep heat from escaping on cold windy days
CROSS SECTION
Pipes containing circulating water
Roof Line

FIGURE 1

The word "photovoltaic" combines two scientific terms: "photo", meaning light, and "voltaic", meaning voltage. Together, the terms mean voltage generated by light energy. Specially treated silicon is manufactured so that when light strikes it, electricity is produced. The cells have no moving parts, and they are very durable. Photovoltaics are commonly called solar cells. (Figure 2)

Solar cells are used by the National Aeronautics and Space Administration (NASA) on space stations, such as Sky-Lab, to change sunlight directly into electricity. There are many terresterial applications for solar cells and when their costs are reduced, photovoltaic cells may produce enough electricity to run a house and your new electric car!



SOLAR CELL

This device converts sunlight directly into electricity, with no moving parts and no pollution

An array of thin silicon cells 10.1000 in. thick

Wires lead to electrical batteries which power lights and motor-driven appliances.

FIGURE 2

IV. What Is Your Energy I.Q.? (Vocabulary)*

1. Barrel: A liquid measure of oil, usually crude oil equal to 42 gallons, or about 306 pounds.
2. Biomass: Plant materials in any form from algae to wood.
3. Blackout: No power supplied.
4. British Thermal Unit (BTU): A unit of energy commonly used to measure heat or chemical energy. The heat required to raise the temperature of one pound of water 1°F. It is usually written BTU, and is equal to 778 foot-pounds of work.
5. Brownout: The lowering of power supplied to customers by a power company when power demand exceeds generating capacity.
6. Calorie: The amount of heat required to raise the temperature of one gram of water one degree celsius.
7. Calorimeter: An apparatus for measuring heat.
8. Coal: A solid organic material formed by the decomposition of plant material without air, containing 75% carbon.
9. Conduction: The transmission of energy directly from one substance or molecule to another.
10. Conserve: To keep from being lost, wasted or damaged.
11. Convection: The transfer of energy by moving masses of liquid or gasses.
12. Conversion: The process by which energy is changed from one form to another.
13. Efficiency: The ratio of work or energy output to the energy input to do the work; it cannot be greater than 1.
14. Electric Current: A flow of charges particles, usually electrons.
15. Empirical: Relying upon observation or experiment.
16. Energy: A force times a distance. It exists in many forms and can be converted from one form to another with some loss in quantity, common units are Calories, BTU's and Kilowatt hours.
17. Fossil Fuels: Fuels such as coal, crude oil, or natural gas, formed from the fossil remains of organic materials.
18. Fuel: A substance that can be burned to produce heat.
19. Fusion: The forming of a larger atomic nucleus from two smaller ones at a very high temperature.
20. Gasoline: A fuel composed primarily of light hydrocarbons, produced by "cracking" crude oil in a refinery.

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*Teachers are encouraged to use the puzzles and games in "Sunny Side Up in Language Arts" to familiarize students with these vocabulary words.

21. Generator: A device which produces electric energy from mechanical energy, as in a motor or water turbine.

22. Heat: A form of kinetic energy resulting from the movement of molecules in matter. It flows from one body to another if there is a temperature difference between them.

23. Insulation: Materials that tend to restrict heat flow.

24. Joule: A metric unit of work or energy; the energy produced by a force of one newton operating through a distance of one meter. One BTU=1055 joules, and one calorie=4.185 joules.

25. Kilowatt (kw): A unit of power, usually used for electric power, equal to 1,000 watts or to energy consumption at a rate of 1,000 joules per second.

26. Kilowatt-hour (kwh): A unit of work or energy. Equivalent of the expenditure of one kilowatt in one hour, about 860,000 calories.

27. Kinetic Energy: The energy of motion; the ability of an object to do work because of its motion.

28. Langley: The amount of energy from solar radiation that, falling on an area of one square centimeter facing the sun on a clear day, equals one calorie of heat.

29. Megawatt: A unit of power equal to 1000 kilowatts or one million watts.

30. Natural Gas: A natural mixture of hydrocarbons often associated with petroleum deposits. It is almost pure methane (CH_4) but usually contains small amounts of more complex hydrocarbons.

31. Newton: The unit of force required to accelerate a mass of 1 kilogram one meter, per second.

32. Nuclear Energy. Atomic energy, the energy released by changes in the nucleus of an atom in a reactor.

33. Petroleum: An oily flammable liquid. It is complex mixture of hydrocarbons and is the raw material for many products.

34. Peak Demand Period: That time of day when the demand for electricity from a powerplant is at its greatest.

35. "Off-Peak" Power: Power generated during a period of low demand.

36. Photosynthesis: The process by which green plants convert radiant energy (sunlight) into chemical potential energy.

37. Photovoltaic: Providing a source of electric current under the influence of light.

38. Photovoltaic Process: The process by which radiant energy is converted directly into electric energy.

39. Quad: 1,000,000,000,000,000 BTU's; the amount of gasoline used by 12,000,000 cars in one year; enough energy to heat 1,000,000 homes for 10 years. Florida consumed 2 quads in 1980.

40. Solar Cell: A device that converts radiant energy into electric energy. Each cell usually produces about 0.5 volts. (See photovoltaic)

41. Solar Energy: The radiation transmitted by the sun. The earth receives 4200 trillion kilowatt-hours each day.

42. Thermal Pollution: Any increase in air or water temperature by waste heat which causes disturbances to the environment.

43. Voltage: The potential difference between two points in a circuit.

44. Watt: A metric unit of power usually used in electric measurements, one watt equals one joule of energy used per second.

45. Work: The product of an external force times the distance an object moves. (Work = Force x Distance).

SUNNY'S

ENERGY LINE

DIRECTIONS: FIRST, Work any problem below and find the answer in the coded line at the bottom of the page.

SECOND, each time the answer appears in the code, write the letter of the problem above it.

KEEP DOING PROBLEMS UNTIL YOU HAVE DECODED THE LINE.

A = THE SUM OF 879, 964, 8204, 6873 AND 27 =

F = THE DIFFERENCE OF 2001 AND 1776 =

K = THE PRODUCT OF 89 AND 76 =

W = THE QUOTIENT OF 6832 AND 8 =

L = 57 MORE THAN THE PRODUCT OF 876 AND 9

T = 707 TIMES THE DIFFERENCE OF 78 AND 12

G = 7885 DIVIDED BY THE DIFFERENCE OF 9 AND 4 =

N = 689 INCREASED BY THE QUOTIENT OF 783 AND 9 =

E = 90 TIMES THE QUOTIENT OF 990 AND 10 =

R = 785 MORE THAN THE DIFFERENCE OF 182 AND 99 =

V = 385 ADDED TO THE PRODUCT OF 465 AND 8 =

H = 88 LESS THAN THE DIFFERENCE 888 MINUS 777 =

S = 3597 REDUCED BY THE PRODUCT OF 56 AND 64 =

O = 3 LESS THAN THE PRODUCT OF 3 TIMES 3 TIMES 3 TIMES 3 =

ENERGY FACT

16947 13-23-78-854-8910-868 46,662-16-947-6754-8910-13

46,662 854 8910 7941 4105 8910 1577 16,947 7941 7941 78 776 13

78 225 23 78 46,662 854 16,947 46,662 8110 868

SUNNY'S GREEN MACHINE

WHAT IS the word used to describe the process of turning sunlight into plant material?

TO FIND THE ANSWER TO THIS QUESTION, FOLLOW THESE DIRECTIONS:

Work any problem below and find the correct answer in the answer column. The number in front of the answer tells you where to put the letter of the problem in the row of boxes at the bottom of the page.

KEEP WORKING PROBLEMS UNTIL YOU HAVE DISCOVERED THE ANSWER.

S	30,783 ÷ 78 =
Y	56,702 ÷ 25 =
I	20,863 ÷ 51 =
O	21,517 ÷ 18 =
H	37,689 ÷ 96 =
S	23,870 ÷ 43 =
N	15,984 ÷ 39 =
P	22,706 ÷ 27 =
!	80,127 ÷ 16 =
T	81,485 ÷ 74 =
E	27,835 ÷ 21 =
S	35,537 ÷ 64 =
S	36,939 ÷ 57 =
H	59,611 ÷ 93 =
T	39,666 ÷ 47 =

1	840	r	26
2	640	r	91
3	1195	r	7
4	1101	r	11
5	555	r	5
6	648	r	3
7	2268	r	2
8	409	r	33
9	843	r	45
10	392	r	57
11	1325	r	10
12	394	r	51
13	409	r	4
14	555	r	17
15	5007	r	15

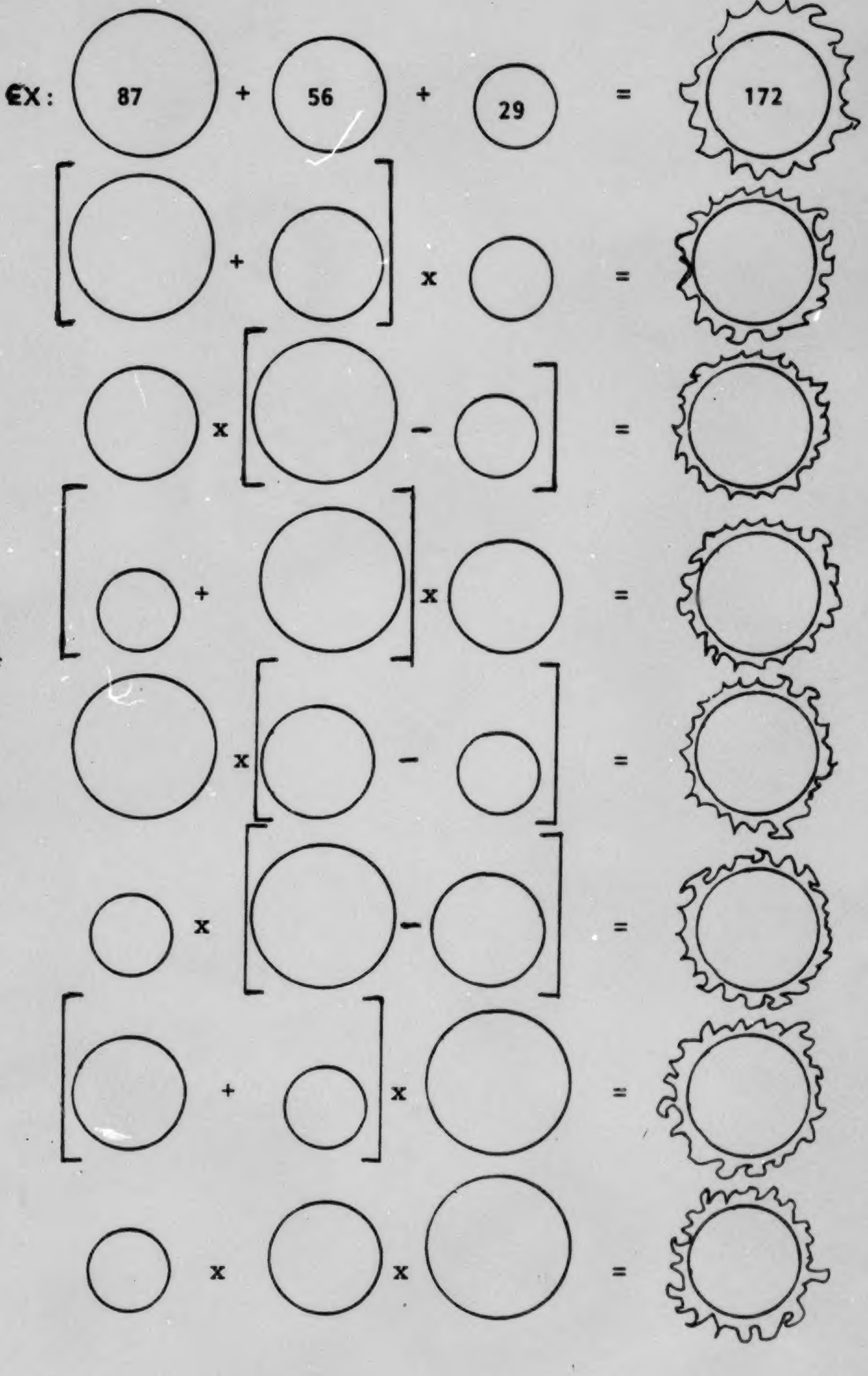
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

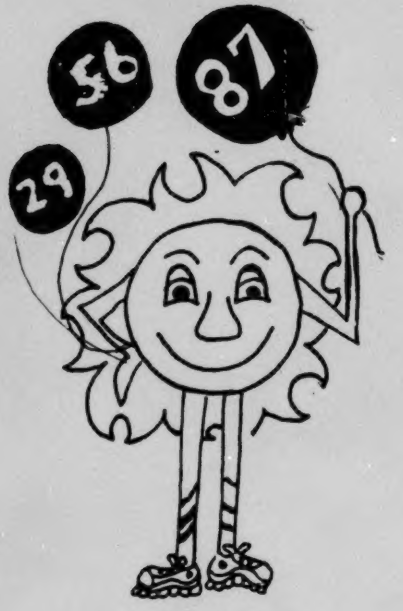
FIND THE SUNS

DIRECTIONS:

Write the correct number in each balloon to the right. Use the number that is in the same size balloon below.

WORK EACH PROBLEM. Check to be sure your answer is in the answer box!

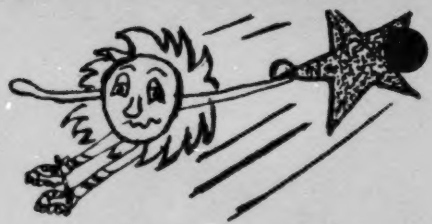

Ex: 87 + 56 + 29 = 172
[+] x =
x [−] =
[+] x =
x [−] =
x [−] =
[+] x =
x x =



ANSWER BOX

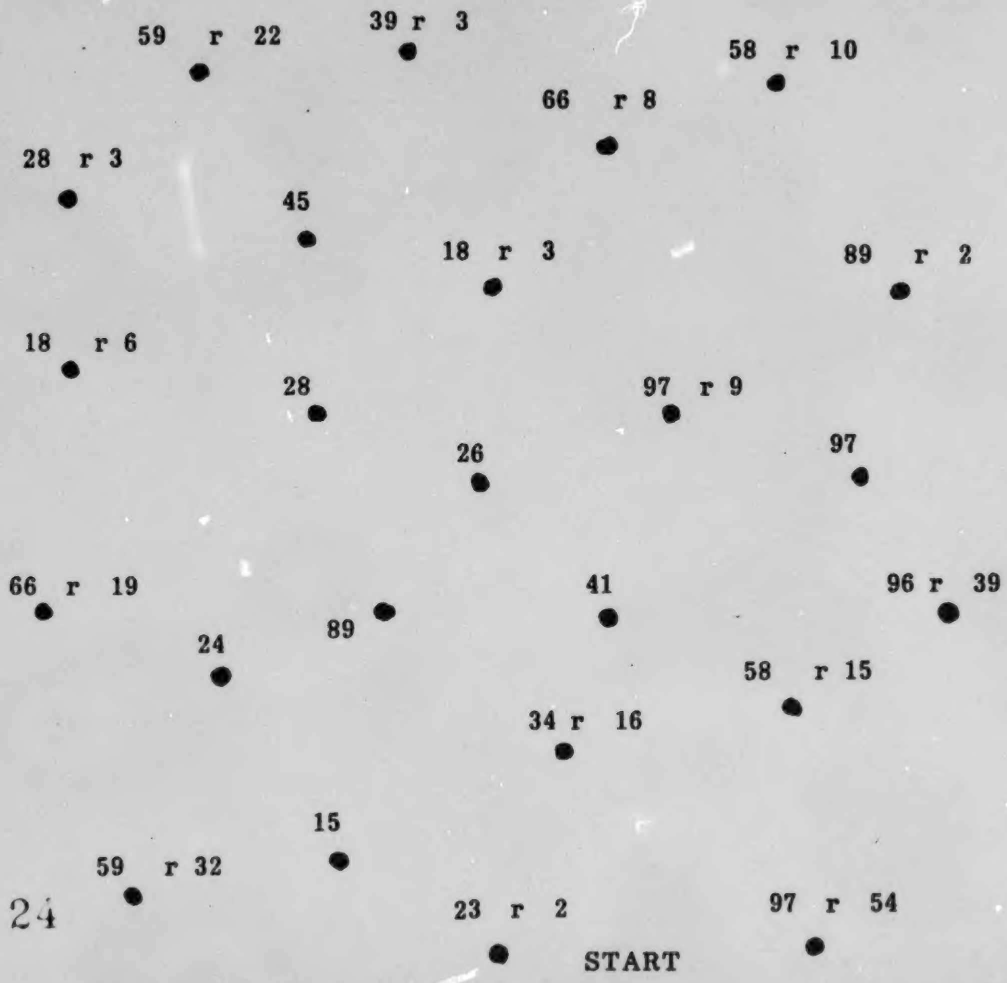
7395
367,388
141,288
142
172
2349
899
6496
4147
3248

SUNNY'S STAR



Work the problems to the right and find the answers below. Connect the dots in the same order as the problems are numbered. You may go through the same dot more than once.

THIS PUZZLE WILL MAKE YOU A STAR!!!!


59 r 22
39 r 3
58 r 10
66 r 8
28 r 3
45
18 r 3
89 r 2
18 r 6
28
97 r 9
26
97
66 r 19
41
96 r 39
24
89
58 r 15
34 r 16
15
59 r 32
23 r 2
START
97 r 54

1. 347 ÷ 15 =

2. 866 ÷ 25 =

3. 2156 ÷ 37 =

4. 5035 ÷ 76 =

5. 4717 ÷ 53 =

6. 1407 ÷ 78 =

7. 3034 ÷ 74 =

8. 4647 ÷ 48 =

9. 1969 ÷ 33 =

10. 8277 ÷ 93 =

11. 1658 ÷ 17 =

12. 784 ÷ 28 =

13. 2624 ÷ 64 =

14. 4005 ÷ 45 =

15. 1589 ÷ 69 =

KNOCK KNOCK

WHO'S THERE?⟶SWARM ⟶ SWARM WHO?⟶

SWARM ____

326-402-743-326-402-621-790-320-326-402-135-222-261-975-990-357-320-610-975-897-261-790

TO DECODE THE LAST LINE OF THIS KNOCK-KNOCK JOKE, FOLLOW THESE DIRECTIONS:

Work any problem below and find your answer in the code. Each time the answer appears in the code, you must write the letter of that problem above it.

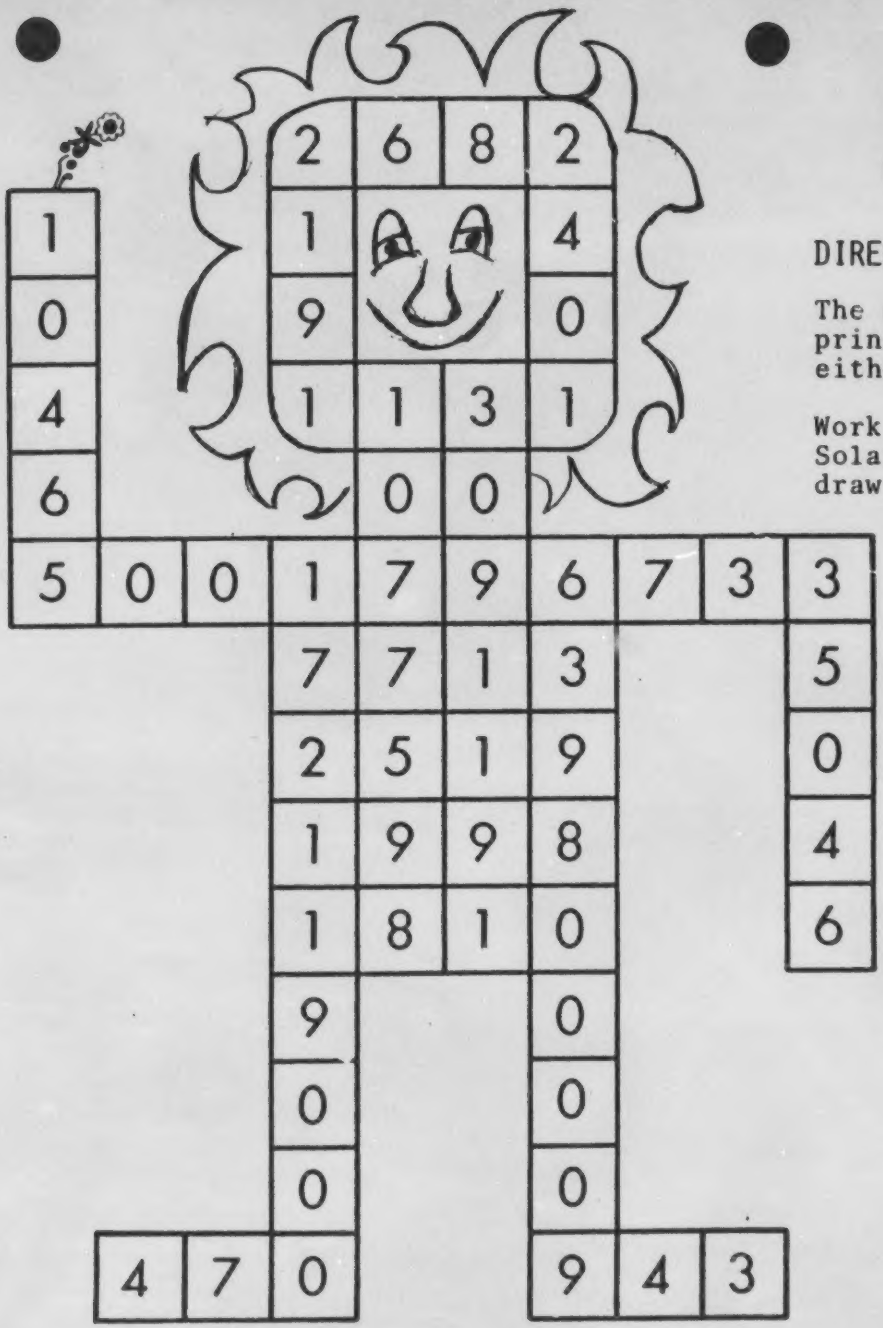
KEEP DOING PROBLEMS UNTIL YOU DISCOVER THE LAST LINE OF THE KNOCK-KNOCK JOKE.

W = (57 x 24) - (25 x 25) =
R = (56 x 48) - (64 x 37) =
A = (55 x 54) - (39 x 67) =
U = (29 x 62) - (53 x 17) =
L = (66 x 94) - (79 x 66) =
T = (27 x 98) - (45 x 45) =
Y = (28 x 69) - (45 x 38) =

S = (86 x 49) - (67 x 59) =
M = (99 x 77) - (78 x 96) =
O = (46 x 59) - (47 x 37) =
E = (94 x 27) - (92 x 19) =
I = (34 x 59) - (30 x 56) =
M = (38 x 53) - (54 x 26) =
N = (66 x 59) - (36 x 97) =

I-5

SOLAR SUNNY



			2	6	8	2			
1			1			4			
0			9			0			
4			1	1	3	1			
6				0	0				
5	0	0	1	7	9	6	7	3	3
			7	7	1	3			5
			2	5	1	9			0
			1	9	9	8			4
			1	8	1	0			6
			9			0			
			0			0			
			0			0			
	4	7	0			9	4	3	

DIRECTIONS:

The correct answer to each problem below is printed in Solar Sunny. The answers run either across or down and they may overlap.

Work each problem and find the answer in Solar Sunny. When you find the answer, draw a rectangle around it.

1. 647 + 3879 + 63 + 5876 =
2. 6471 − 3789 =
3. 18 X (643 + 928 + 376) =
4. 2 X 538,799 =
5. (647 X 0) + 940 + 3 =
6. (43 X 26) − (36 X 18) =
7. 57,373 X 3000 =
8. 6,409,753 − 3,318,562 =
9. (181 X 10) + (181 X 0) =
10. 297 + 468 + 397 + 964 + 393 =
11. 31,506 − 29,315 =

DIRECTIONS: FIRST, work each problem and find your answer in the rectangle below. The correct answers run across from left to right. SECOND, cross out each correct answer. When you finish, there will be 34 boxes not crossed out.

STARTING ON THE TOP LINE AND WORKING FROM LEFT TO RIGHT, PRINT THE 34 LETTERS THAT REMAIN INTO THE BOXES AT THE BOTTOM OF THE PAGE. A HIDDEN MESSAGE WILL APPEAR!

1. 54,039 +68,175

2. 70,957 +34,824

3. 61,198 +70,495

4. 67,508 +28,413

5. 67,192 +70,338

6. 80,390 +27,881

7. 89,898 +77,777

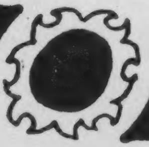
8. 93,007 +64,118

			K_1	H_2	D_2	S_2	X_1	T_4	T_7	H_5	S_5	D_2	O_5	N_0	Z_9	E_4	S_4
			U_7	N_3	I_0	S_0	H_1	D_6	W_7	P_6	Q_7	J_5	T_4	H_0	E_3	S_9	O_1
U_0	R_3	C_6	E_0	R_3	S_9	O_0	U_9	B_5	O_4	F_2	D_3	S_6	H_1	T_3	Z_3	A_8	L_9
			L_7	L_0	I_0	F_8	E_2	Y_1	R_3	E_7	M_5	P_3	T_0	O_7	N_2	E_4	A_1
			R_8	I_1	U_3	Y_1	A_6	Q_9	Y_3	T_7	H_7	T_2	X_8	V_8	M_8	R_9	$!_4$

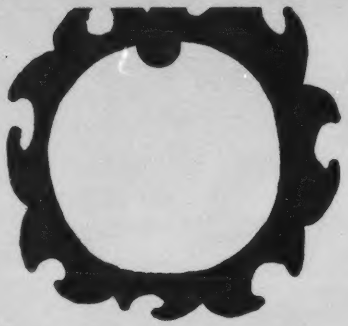
☐☐☐ ☐☐☐ ☐☐ ☐☐☐ ☐☐☐☐☐ ☐☐ ☐☐☐ ☐☐☐

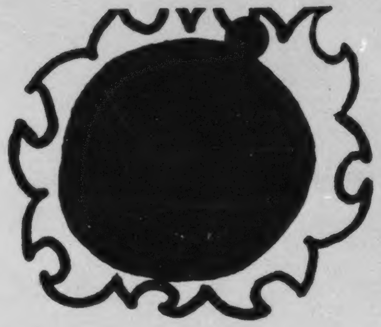
☐☐☐☐☐ ☐

SUNNY



MESSAGE





ENERGY UNDER THE SUN

Work any problem below and find your answer in the code at the bottom of the page. Each time you see the answer in the code, write the letter of that problem ABOVE it. KEEP WORKING PROBLEMS UNTIL YOU HAVE DECODED THE LIMERICK.

G = $\frac{1}{2}$ X 20 =

D = 15 X $\frac{1}{3}$ =

B = $\frac{3}{4}$ X 28 =

P = 30 X $\frac{2}{5}$ =

Q = $\frac{6}{7}$ X 21 =

F = 40 X $\frac{5}{8}$ =

M = $\frac{5}{6}$ X 36 =

W = 72 X $\frac{4}{9}$ =

Y = $\frac{7}{10}$ X 40 =

A = 45 X $\frac{4}{5}$ =

C = $\frac{7}{8}$ X 64 =

U = 49 X $\frac{2}{7}$ =

I = $\frac{1}{12}$ X 48 =

H = 60 X $\frac{1}{20}$ =

V = $\frac{5}{8}$ X 96 =

R = $\frac{4}{7}$ X 42 =

T = 36 X $\frac{2}{9}$ =

L = $\frac{3}{10}$ X 20 =

O = 60 X $\frac{7}{12}$ =

E = $\frac{1}{8}$ X 56 =

S = 33 x $\frac{3}{11}$

N = $\frac{11}{15}$ X 45 =

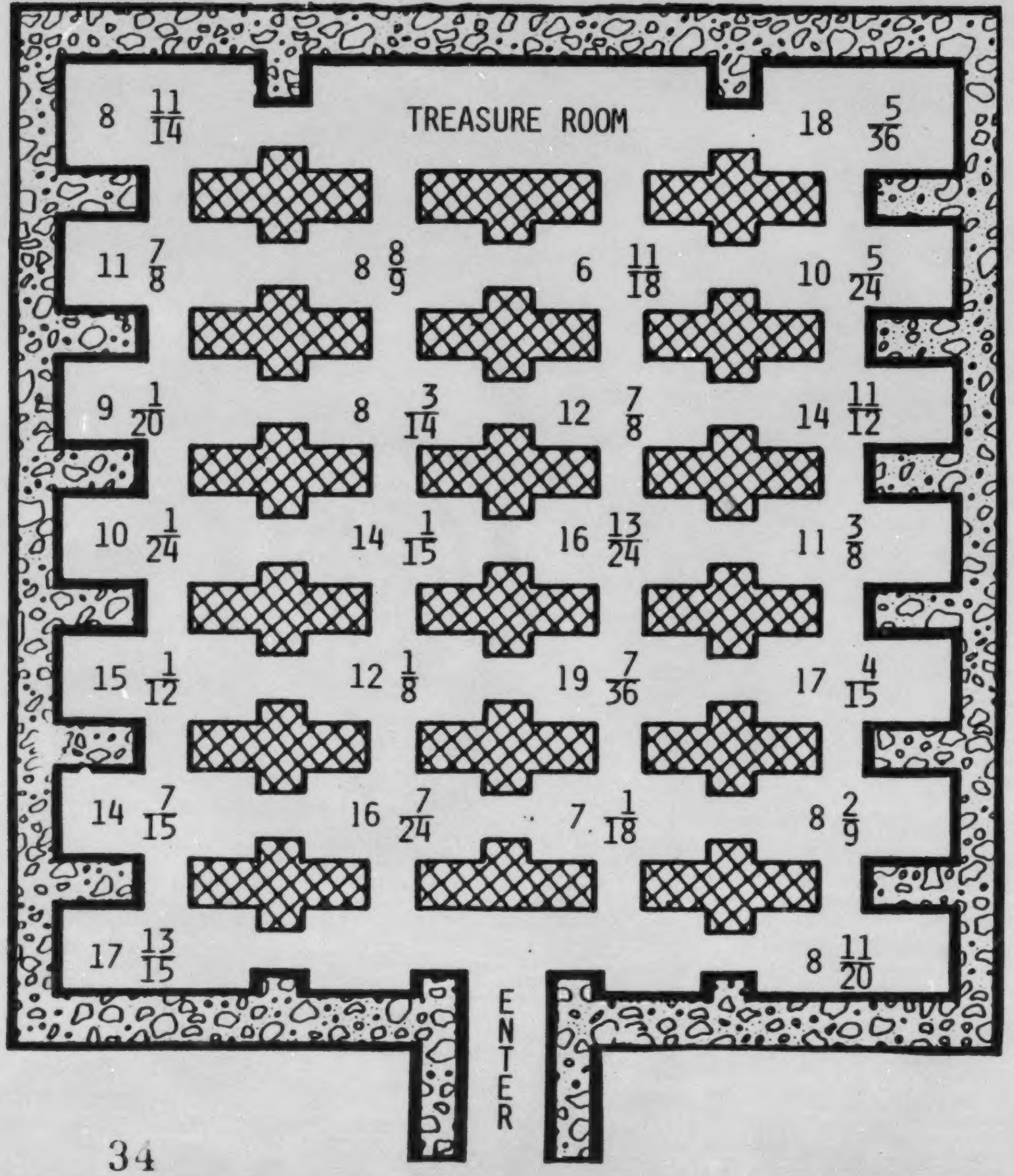
I-8

35-33-7 • 18-14-36-5 • 4-9 • 7-18-14-36-5 • 8-35 • 36-30-35-14-33-8 • 35-25 •
10-36-9-35-6-4-33-7 • 14-9-7-5 • 21-28 • 8-32-7-6-60-7 • 30-4-6-6-4-35-33 • 56-36-24-9 •
4-33 • 35-33-7 • 28-7-3-24 • 7-33-35-14-10-3 • 7-33-7-24-10-28 • 8-35 • 3-7-36-8•
35-33-7 • 30-4-6-6-4-35-33 • 3-35-30-7-9 • 25-35-24 • 8-7-33 • 28-7-3-24-9•
25-6-35-24-1-5-36 • 56-35-33-9-14-30-7-5 • 8-32-35 • 18-14-36-5-9• 4-33•
1980!!!

ENTER-MAZE

Someone left the light on in the Treasure Room. Help Sunny find the path to turn it off.

Work each problem below and find your answer in the maze. CIRLCE the answer.


TREASURE ROOM
8 11/14
18 5/36
11 7/8
8 8/9
6 11/18
10 5/24
9 1/20
8 3/14
12 7/8
14 11/12
10 1/24
14 1/15
16 13/24
11 3/8
15 1/12
12 1/8
19 7/36
17 4/15
14 7/15
16 7/24
7 1/18
8 2/9
17 13/15
8 11/20
ENTER

I-9

1. $7\frac{5}{8} + 5\frac{1}{4}$

2. $9\frac{1}{2} + 1\frac{7}{8}$

3. $6\frac{3}{4} + 8\frac{1}{3}$

4. $6\frac{1}{4} + 2\frac{4}{5}$

5. $7\frac{3}{5} + 9\frac{2}{3}$

6. $9\frac{2}{3} + 6\frac{5}{8}$

7. $3\frac{4}{9} + 3\frac{1}{6}$

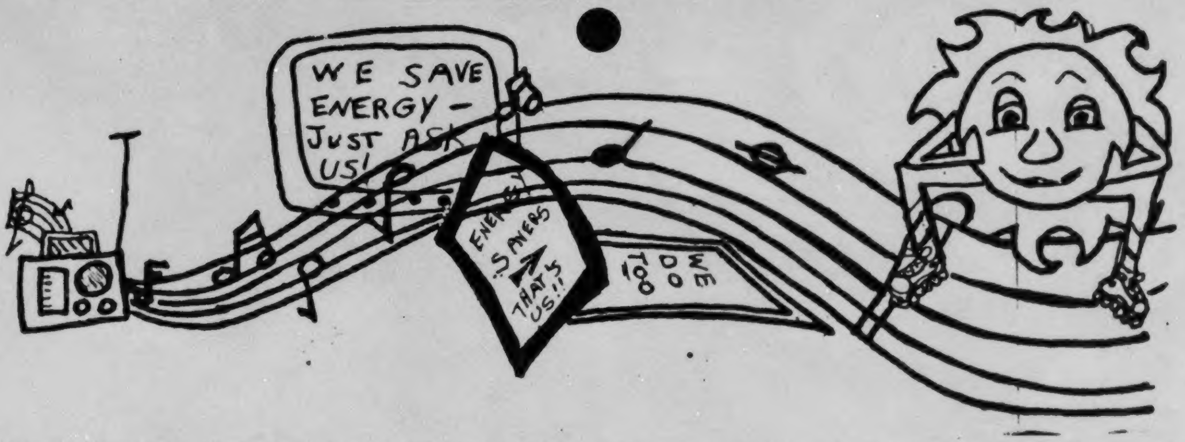
8. $5\frac{1}{6} + 9\frac{3}{10}$

9. $3\frac{5}{9} + 4\frac{2}{3}$

10. $4\frac{5}{8} + 5\frac{5}{12}$

11. $3\frac{5}{7} + 4\frac{1}{2}$

12. $9\frac{3}{4} + 9\frac{4}{9}$


WE SAVE ENERGY — JUST ASK US!
ENERGY SAVERS THAT'S US!!
WE DO TOO

Cross out each fraction in lowest terms AND ITS LETTER. Several letters will be left in each line. Write these letters, reading across from left to right, in the space under each row of letters and fractions. YOU WILL SPELL OUT THE WORDS OF A TERRIFIC NEW SONG (make up your own tune!)

J $\frac{3}{9}$ A $\frac{1}{2}$ U $\frac{9}{12}$ R $\frac{2}{3}$ M $\frac{2}{4}$ B $\frac{3}{8}$ P $\frac{5}{15}$ S $\frac{1}{12}$ M $\frac{7}{9}$ F $\frac{4}{10}$ A $\frac{3}{10}$ O $\frac{6}{8}$ R $\frac{15}{20}$ F $\frac{5}{8}$ M $\frac{2}{5}$ L $\frac{3}{4}$ J $\frac{7}{14}$ O $\frac{12}{15}$ B $\frac{1}{3}$ Y $\frac{4}{16}$

K $\frac{4}{15}$ T $\frac{6}{11}$ S $\frac{6}{18}$ T $\frac{5}{6}$ M $\frac{4}{6}$ A $\frac{3}{7}$ I $\frac{4}{24}$ L $\frac{8}{12}$ E $\frac{3}{12}$ S $\frac{5}{14}$ W $\frac{2}{9}$ B $\frac{11}{22}$ R $\frac{10}{25}$ O $\frac{1}{6}$ I $\frac{5}{20}$ A $\frac{4}{13}$ G $\frac{2}{8}$ H $\frac{10}{16}$ O $\frac{3}{11}$ T $\frac{20}{25}$

S $\frac{5}{16}$ E $\frac{5}{10}$ A $\frac{7}{10}$ V $\frac{8}{18}$ E $\frac{18}{14}$ R $\frac{2}{6}$ B $\frac{5}{7}$ Y $\frac{7}{21}$ B $\frac{7}{12}$ O $\frac{3}{20}$ T $\frac{2}{30}$ H $\frac{3}{27}$ A $\frac{7}{8}$ I $\frac{4}{12}$ N $\frac{2}{10}$ G $\frac{10}{15}$ S $\frac{11}{18}$ I $\frac{4}{22}$ T $\frac{7}{24}$ S $\frac{13}{26}$

W $\frac{8}{21}$ A $\frac{9}{14}$ G $\frac{2}{9}$ S $\frac{4}{8}$ T $\frac{4}{5}$ U $\frac{8}{16}$ P $\frac{8}{17}$ N $\frac{14}{21}$ O $\frac{9}{11}$ M $\frac{7}{15}$ N $\frac{6}{9}$ Y $\frac{12}{24}$ M $\frac{2}{23}$ B $\frac{12}{18}$ R $\frac{10}{24}$ I $\frac{6}{12}$ G $\frac{15}{25}$ H $\frac{12}{16}$ E $\frac{6}{19}$ T $\frac{2}{6}$

B $\frac{9}{27}$ E $\frac{14}{18}$ G $\frac{5}{9}$ C $\frac{6}{12}$ A $\frac{6}{10}$ I $\frac{7}{16}$ U $\frac{6}{16}$ S $\frac{3}{18}$ E $\frac{5}{25}$ T $\frac{6}{7}$ Y $\frac{2}{10}$ O $\frac{10}{18}$ U $\frac{6}{15}$ R $\frac{2}{16}$ S $\frac{11}{24}$ W $\frac{15}{18}$ O $\frac{10}{20}$ E $\frac{11}{12}$ R $\frac{6}{26}$ K $\frac{12}{27}$

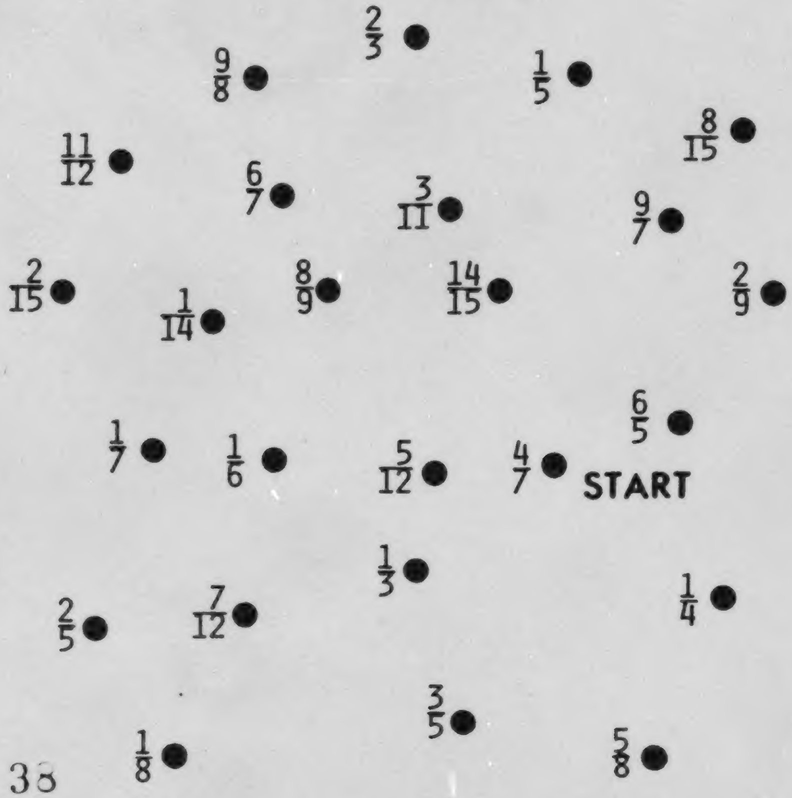
I $\frac{17}{18}$ R $\frac{7}{30}$ I $\frac{2}{12}$ S $\frac{14}{16}$ P $\frac{9}{10}$ E $\frac{6}{25}$ O $\frac{12}{20}$ V $\frac{6}{24}$ T $\frac{3}{14}$ T $\frac{3}{15}$ M $\frac{7}{13}$ O $\frac{4}{20}$ O $\frac{9}{20}$ F $\frac{8}{12}$ S $\frac{14}{18}$ I $\frac{20}{24}$ G $\frac{2}{4}$ H $\frac{16}{18}$ T $\frac{16}{24}$ E $\frac{9}{16}$

STAR LIGHT — STAR BRIGHT

Since the sun is our nearest star, it provides us with an alternate source of energy.

Work the problems to the right and find the correct answers below. Connect the dots in the same order as the problems are numbered. After every four dots, lift your pencil and begin again with the next dot (do NOT connect dot 4 to the next dot 1.) You may go through the same dot more than once.

THIS PUZZLE WILL MAKE YOU A STAR!



1. $\frac{2}{3}$ X $\frac{6}{7}$ =
2. $\frac{3}{8}$ X $\frac{5}{3}$ =
3. $\frac{2}{5}$ X $\frac{5}{6}$ =
4. $\frac{11}{12}$ X $\frac{8}{11}$ =

LIFT PENCIL

1. $\frac{1}{22}$ X $\frac{11}{4}$ =
2. $\frac{7}{4}$ X $\frac{8}{15}$ =
3. $\frac{8}{9}$ X $\frac{3}{4}$ =
4. $\frac{10}{9}$ X $\frac{12}{15}$ =

LIFT PENCIL

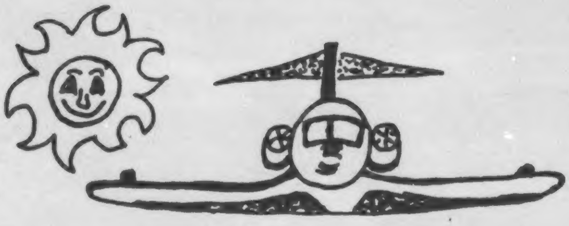
1. $\frac{3}{7}$ X $\frac{7}{9}$ =
2. $\frac{3}{10}$ X $\frac{5}{12}$ =
3. $\frac{9}{8}$ X $\frac{4}{27}$ =
4. $\frac{5}{9}$ X $\frac{6}{15}$ =

LIFT PENCIL

1. $\frac{3}{2}$ X $\frac{5}{12}$ =
2. $\frac{8}{3}$ X $\frac{6}{18}$ =
3. $\frac{1}{9}$ X $\frac{6}{5}$ =
4. $\frac{3}{8}$ X $\frac{4}{9}$ =

LIFT PENCIL

1. $\frac{21}{25}$ X $\frac{10}{9}$ =
2. $\frac{7}{12}$ X $\frac{8}{21}$ =
3. $\frac{2}{5}$ X $\frac{10}{7}$ =
4. $\frac{9}{20}$ X $\frac{8}{27}$ =

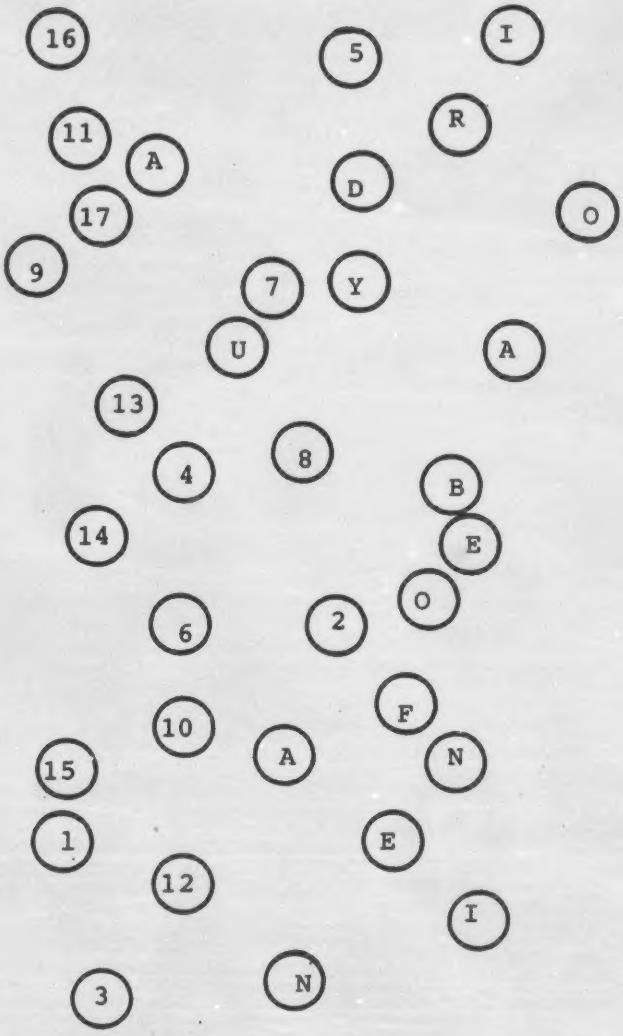


FLY SUNNY

HOW much fuel does Sunny need to fly around the world?

Figure out the LEAST COMMON DENOMINATOR for each pair of fractions on the left. Draw a straight line connecting each problem with its answer. Each line will cross a number and a letter. The number tells you where to put the letter in the line of boxes at the bottom of the page.

LCD OF $\frac{1}{2}$ AND $\frac{3}{4}$ ■	■ 12
LCD OF $\frac{2}{3}$ AND $\frac{7}{9}$ ■	■ 21
LCD OF $\frac{3}{4}$ AND $\frac{5}{6}$ ■	■ 10
LCD OF $\frac{2}{7}$ AND $\frac{1}{14}$ ■	■ 4
LCD OF $\frac{1}{2}$ AND $\frac{4}{5}$ ■	■ 18
LCD OF $\frac{5}{6}$ AND $\frac{2}{9}$ ■	■ 24
LCD OF $\frac{1}{3}$ AND $\frac{2}{5}$ ■	■ 9
LCD OF $\frac{3}{8}$ AND $\frac{2}{3}$ ■	■ 30
LCD OF $\frac{1}{5}$ AND $\frac{3}{4}$ ■	■ 40
LCD OF $\frac{1}{6}$ AND $\frac{3}{5}$ ■	■ 14
LCD OF $\frac{3}{4}$ AND $\frac{2}{9}$ ■	■ 15
LCD OF $\frac{2}{3}$ AND $\frac{1}{2}$ ■	■ 16
LCD OF $\frac{5}{8}$ AND $\frac{1}{5}$ ■	■ 28
LCD OF $\frac{1}{7}$ AND $\frac{1}{3}$ ■	■ 20
LCD OF $\frac{5}{16}$ AND $\frac{1}{4}$ ■	■ 36
LCD OF $\frac{2}{7}$ AND $\frac{3}{4}$ ■	■ 72
LCD OF $\frac{1}{8}$ AND $\frac{2}{9}$ ■	■ 6



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

LOVE LETTER IN THE SUN

What did the walls of the house say to the roof top?

To find the love message:

Work each problem and find your answer in the hearts at the bottom of the page,

Then

Write the letter of your answer in each heart.

Ⓖ $6\frac{1}{4} - 2\frac{1}{2}$

Ⓡ $9\frac{1}{8} - 3\frac{1}{4}$

Ⓓ $6\frac{1}{2} - 1\frac{3}{4}$

Ⓤ $8\frac{1}{3} - 1\frac{5}{6}$

Ⓜ $7\frac{1}{10} - 5\frac{3}{5}$

Ⓐ $5\frac{1}{3} - 1\frac{3}{4}$

Ⓔ $9\frac{1}{15} - 2\frac{2}{5}$

Ⓘ $7\frac{1}{3} - 5\frac{4}{5}$

1-13

Ⓞ $8\frac{1}{4} - 5\frac{3}{5}$

Ⓝ $5\frac{1}{6} - 1\frac{7}{8}$

Ⓗ $6\frac{2}{9} - 4\frac{2}{3}$

Ⓛ $4\frac{1}{4} - 1\frac{7}{10}$

Ⓑ $9\frac{7}{12} - 5\frac{5}{8}$

Ⓣ $8\frac{1}{10} - 2\frac{5}{6}$

$1\frac{5}{9}$ $3\frac{7}{12}$ $3\frac{7}{24}$ $3\frac{3}{4}$ $3\frac{7}{12}$ $5\frac{7}{8}$ $2\frac{3}{20}$ $6\frac{1}{2}$ $3\frac{7}{24}$ $4\frac{3}{4}$ $1\frac{1}{2}$ $6\frac{2}{3}$ $3\frac{7}{12}$

$2\frac{11}{20}$ $1\frac{8}{15}$ $5\frac{4}{15}$ $5\frac{4}{15}$ $2\frac{11}{20}$ $6\frac{2}{3}$ $3\frac{23}{24}$ $1\frac{8}{15}$ $5\frac{4}{15}$ - $2\frac{11}{20}$ $2\frac{3}{20}$ $3\frac{7}{24}$ $3\frac{3}{4}$ $6\frac{2}{3}$ $5\frac{7}{8}$

SUNNY FACT OF HISTORY

A SUNNY FACT OF HISTORY IS WRITTEN IN CODE AT THE BOTTOM OF THE PAGE.

TO BREAK THE CODE:

FIRST, solve for the MISSING FACTOR in any equation below, and find your answer in the code.

SECOND, each time the answer appears in the code, write the letter in that problem above it.

I-14

$\frac{6}{7}$ X H = 36; H =

P X $\frac{9}{12}$ = 72; P =

O X $\frac{7}{9}$ = 63; O =

$\frac{2}{3}$ X W = 74; W =

N X $\frac{3}{5}$ = 48; N =

$\frac{5}{7}$ X L = 465; L =

4 X R = 396; R =

F X $\frac{7}{8}$ = 406; F =

E X $\frac{9}{10}$ = 882; E =

V X $\frac{4}{5}$ = 184; V =

$\frac{8}{13}$ X C = 632; C =

$\frac{5}{6}$ X T = 390; T =

$\frac{6}{7}$ X D = 294; D =

$\frac{10}{15}$ X U = 100; U =

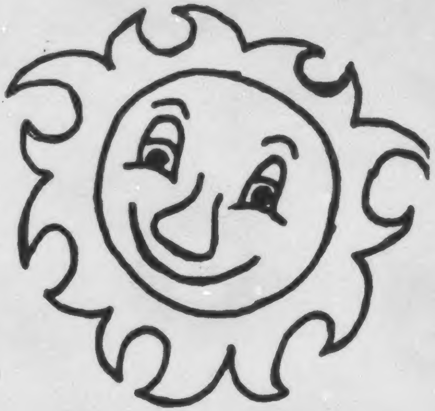
A X $\frac{8}{9}$ = 376; A =

25 X S = O; S =

G X $\frac{7}{12}$ = 434; G =

Y X $\frac{2}{5}$ = 64; Y =

I X $\frac{8}{10}$ = 40; I =



0 980 230 980 80 • 96 980 99 1027 980 80 486 • 81 464 • 468 42 980 •

111 81 99 651 343 0 • 96 81 96 150 651 423 468 50 81 80 • 150 O 980 O

468 42 50 99 468 160 • 468 42 99 980 980 • 96 980 99 1027 980 80 468 •

81 464 • 468 42 980 • 111 81 99 651 343 0 • 980 80 980 99 744 160 • 99 980 O

81 150 99 1027 980 0 •

SUN-MISER

In each row only three rectangles contain a fraction that is greater than the given fraction. Circle these three fractions.

Over each fraction you have circled, notice the small number and letter.

The small number tells you which box at the bottom of the page to put the letter in.

You will spell out a six-word message.

		3-S	15-E	10-V	9-E	6-M	13-L	20-V
I	GREATER THAN $\frac{1}{2}$	$\frac{2}{5}$	$\frac{5}{8}$	$\frac{1}{3}$	$\frac{7}{12}$	$\frac{5}{10}$	$\frac{3}{8}$	$\frac{4}{7}$
		13-A	18-P	3-L	7-O	10-I	6-W	17-T
II	GREATER THAN $\frac{1}{3}$	$\frac{4}{9}$	$\frac{1}{4}$	$\frac{2}{5}$	$\frac{8}{24}$	$\frac{3}{9}$	$\frac{3}{8}$	$\frac{2}{7}$
		4-G	7-A	21-M	18-S	2-A	5-O	11-H
III	GREATER THAN $\frac{2}{5}$	$\frac{8}{20}$	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{7}{15}$	$\frac{10}{25}$	$\frac{3}{10}$	$\frac{9}{20}$
		4-A	16-A	27-S	8-P	19-A	10-R	14-B
IV	GREATER THAN $\frac{1}{4}$	$\frac{3}{8}$	$\frac{4}{16}$	$\frac{5}{16}$	$\frac{6}{24}$	$\frac{1}{6}$	$\frac{3}{10}$	$\frac{1}{5}$
		16-R	3-V	12-R	1-P	21-E	6-T	5-R
V	GREATER THAN $\frac{3}{8}$	$\frac{5}{12}$	$\frac{5}{16}$	$\frac{1}{3}$	$\frac{9}{24}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{7}{16}$
		9-A	12-R	1-T	2-O	19-A	8-H	14-T
VI	GREATER THAN $\frac{5}{6}$	$\frac{7}{9}$	$\frac{4}{5}$	$\frac{3}{4}$	$\frac{11}{12}$	$\frac{7}{8}$	$\frac{2}{3}$	$\frac{13}{15}$
		8-S	1-S	12-E	15-H	8-T	11-S	12-A
VII	GREATER THAN $\frac{2}{3}$	$\frac{8}{12}$	$\frac{11}{15}$	$\frac{5}{6}$	$\frac{5}{9}$	$\frac{3}{4}$	$\frac{3}{5}$	$\frac{5}{8}$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

SUNNY'S FACT

Anyone who has had a sunburn, walked through a greenhouse, hung clothes on the line to dry, or watched spring arrive, recognized the power of the sun.

1. 1.68 ÷ 8.4 = _____ E
2. .342 ÷ .57 = _____ E
3. 2.769 ÷ .39 = _____ E
4. 2.288 ÷ 4.4 = _____ R
5. 8.82 ÷ .98 = _____ R
6. 113.4 ÷ 6.3 = _____ S
7. .1875 ÷ .075 = _____ N
8. 1.54 ÷ .035 = _____ Y
9. 153.0 ÷ 1.8 = _____ T
10. 9.711 ÷ .83 = _____ G
11. 9.072 ÷ .056 = _____ H
12. 5.372 ÷ 7.9 = _____ A

SUPER
SUNNY

In a one to two week period, the sun transmits more

___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___
7.1 2.5 .2 .52 11.7 44 to the .6 .68 9 85 162 18

surface than all of the

___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___
7.1 2.5 .2 .52 11.7 44 stored in the .6 .68 9 85 162 18

known reserves of coal, oil and natural gas.

ENERGY MESSAGE

FIRST, work each problem and find your answer in the rectangle below. The correct answers run across from left to right.

SECOND, cross out each correct answer. When you finish, there will be 32 boxes not crossed out.

STARTING ON THE TOP LINE AND WORKING FROM LEFT TO RIGHT, PRINT THE 32 LETTERS THAT REMAIN IN THE BOXES AT THE BOTTOM OF THE PAGE. A HIDDEN MESSAGE WILL APPEAR!!!

1. 6.4 + .53 + .008 + 2.17 =
2. 3.6 + 1.9 + 2.22 + .081 =
3. 43.2 + .804 + 6.54 + 7.2 =
4. 10 + .637 + .142 + 1.05 =
5. 356.2 + 19.04 + .11 + 24 =
6. 6.4 + .019 + 2.05 + .08 =
7. 34.6 + .458 + 3.005 + .71 =
8. 222.95 + 865 + .07 + 3.4 =
9. 34.007 + .958 + 2.347 + 20.1 =
10. 507.4 + 296 + .39 + 42.17 =

V 9.	S 1	N 0	T 8	E 5.	L 7	I 1	O 0	C 9	W 1.	A 4	E 2	E 8	J 3	S 9	B 9.	M 3	S 5	C 2	T 2
R 3	I 4	B 7	E 8	U 0	Y 1	C 9	U 8.	F 5	H 4	W 9	I 8.	T 6	O 5	P 7.	D 4	S 1	F 2	Y 5.	W 1
A 4	S 3.	A 2	J 1	X 1.	M 8	P 2	N 9	S 8	H 7.	O 4	S 3	T 8.	U 7	I 7	N 3	C 6	K 5.	I 2	N 1
G 8.	D 4	L 8	K 4	I 5.	S 9	T 6	I 3.	S 2	C 0	O 5	U 5	E 7.	R 7	Y 4	Z 4	V 6.	E 7	R 3	Y 9

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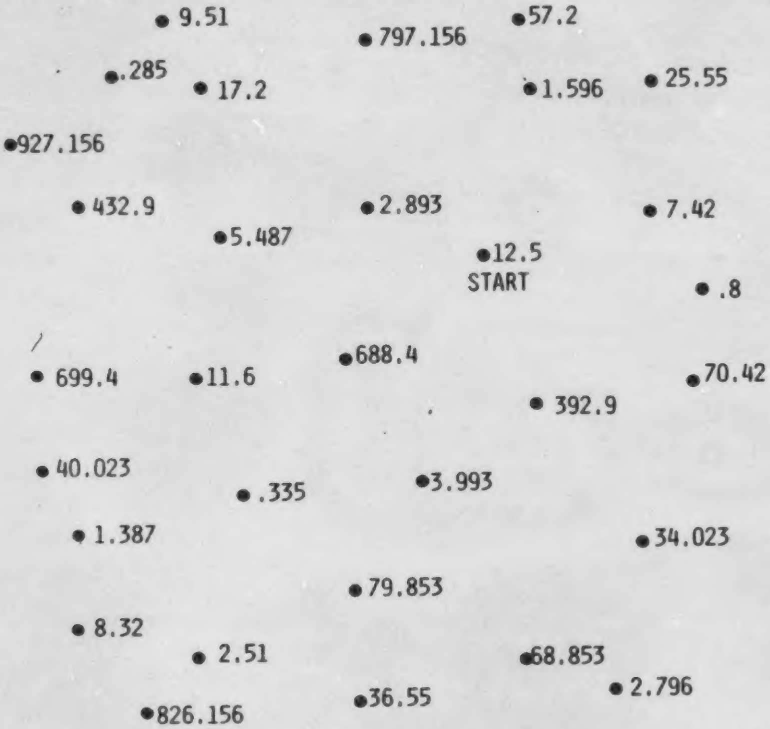
STAR SUN

DIRECTIONS:

Work the problems to the right and find the correct answers below. Connect the dots in the same order as the problems are numbered. You may go through the same dot more than once. THIS PUZZLE WILL MAKE YOU A STAR!


9.51
797.156
57.2
.285
17.2
1.596
25.55
927.156
432.9
2.893
7.42
5.487
12.5
START
.8
699.4
11.6
688.4
70.42
392.9
40.023
.335
3.993
1.387
34.023
79.853
8.32
2.51
68.853
2.796
826.156
36.55

1. 16.8 - 4.3 =
2. 9.82 - 2.4 =
3. 3.7 - 1.19 =
4. .64 - .305 =
5. 72.4 - 1.98 =
6. 600.7 - 167.8 =
7. 72.19 - 3.337 =
8. 801.36 - 4.204 =
9. .9 - .565 =
10. 2.037 - .65 =
11. 2.7 - 1.104 =
12. 67.007 - 63.014 =
13. 38.6 - 4.577 =
14. 19.0 - 1.8 =
15. 37 - .45 =
16. 4 - .007 =
17. 700 - .6 =
18. 395.2 - 382.7 =

SOUND OFF FOR ENERGY

FIRST, write each printed numeral as a decimal and find your answer in the rectangle below. The correct answers run across from left to right.
SECOND, cross out each correct answer.
STARTING ON THE TOP LINE AND WORKING FROM LEFT TO RIGHT, PRINT THE 29 LETTERS THAT REMAIN INTO THE BOXES AT THE BOTTOM OF THE PAGE.
A HIDDEN MESSAGE WILL APPEAR!!!!

1. FIVE AND SEVEN TENTHS =
2. SIXTEEN AND THIRTY-FOUR HUNDREDTHS =
3. TWENTY-FIVE AND ONE HUNDRED THIRTY-NINE THOUSANDTHS =
4. THREE HUNDRED FIFTY-FIVE AND EIGHTY-SIX HUNDREDTHS =
5. FOURTY-FOUR AND SIX HUNDREDTHS =
6. ELEVEN AND SEVENTY-EIGHT THOUSANDTHS =
7. EIGHT HUNDRED FIFTY-SIX AND FORTY-TWO THOUSANDTHS =
8. ONE THOUSAND, TWO HUNDRED NINE AND EIGHT TENTHS =
9. NINE AND FIVE TENTHS =
10. SEVEN AND FOUR HUNDRED THREE THOUSANDTHS =
11. FIVE THOUSAND SIX HUNDRED EIGHTY-EIGHT AND SEVEN TENTHS =

$Y_{5.}$	S_7	T_2	U_4	$I_{7.}$	E_4	S_0	G_3	$R_{2.}$	N_9	W_4	$O_{4.}$	P_0	C_6	O_9
$F_{6.}$	K_1	B_2	N_0	$A_{9.}$	W_8	F_2	T_2	J_1	$M_{6.}$	U_3	I_4	$V_{7.}$	W_3	H_0
E_1	$N_{2.}$	I_3	V_5	$C_{5.}$	P_8	T_6	N_7	$O_{6.}$	B_3	O_9	$R_{9.}$	E_5	D_0	Y_5
L_5	P_6	O_8	D_8	N_7	S_3	W_7	A_2	L_1	$R_{1.}$	G_0	O_7	A_8	T_4	C_6
H_7	$I_{8.}$	0_2	$K_{5.}$	Q_1	U_3	I_9	$N_{6.}$	Y_8	R_5	$K_{6.}$	E_0	F_4	X_2	G_1

				■				■			■					■							■		

SUNNY RAYS

Figure out which digit has the given place value in each decimal below. Write these digits in order, into the first row of boxes at the bottom of the page. Then use the decoder key to decode each digit. As you decode each digit, write the letters into the bottom row of boxes. You will find Florida's oldest use of solar energy.

1 6.45 (TENTHS)

2 25.075 (HUNDREDTHS)

3 976.42 (ONES)

4 64.70551 (THOUSANDTHS)

5 21.34 (TENS)

6 4.740513 (MILLIONTHS)

7 61,457.23 (THOUSANDS)

8 235.60087 (TEN THOUSANDTHS)

9 39.465203 (HUNDRED THOUSANDTHS)

0 1,435,907.2 (MILLIONS)

11 846,124.831017 (TEN THOUSANDS)

12 858,124.836017 (THOUSANDTHS)

13 856,124.831017 (HUNDRED THOUSANDS)

14 856,124.831017 (MILLIONTHS)

15 856,624.831017 (HUNDREDS)

16 856,124.811017 (HUNDREDTHS)

17 846,124.831017 (TEN THOUSANDTHS)

18 856,124.631017 (TENTHS)

19 956,124.831087 (HUNDRED THOUSANDTHS)

DECODER KEY →

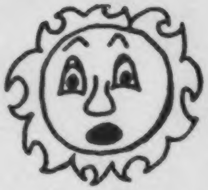
0	1	2	3	4	5	6	7	8
W	A	O	L	T	S	E	H	R

SUNNY'S KEEPER

Each of the two blocks below is divided into 18 boxes. Change each decimal in the top block into a mixed numeral. Find this mixed numeral in the bottom block. Then write the word from the top box into the bottom box. Keep working and you will spell out an energy fact.

1.2 IN	1.23 EXTERIOR	1.234 FUEL	12.3 OF	12.03 PERCENT	12.003 TWO
12.34 INSULATION	12.034 BY	12.304 WILL	5.006 WALLS	5.067 OF	5.06 REDUCE
5.607 THE	5.678 EIGHT	56.078 INCHES	56.78 A	56.708 CONSUMPTION	56.007 HOUSE

$12\frac{3}{1000}$	$56\frac{78}{1000}$	$5\frac{67}{1000}$	$12\frac{34}{100}$	$1\frac{2}{10}$	$5\frac{607}{1000}$
$1\frac{23}{100}$	$5\frac{6}{1000}$	$12\frac{3}{10}$	$56\frac{78}{100}$	$56\frac{7}{1000}$	$12\frac{304}{1000}$
$5\frac{6}{100}$	$1\frac{234}{1000}$	$56\frac{708}{1000}$	$12\frac{34}{1000}$	$5\frac{678}{1000}$	$12\frac{3}{100}$



A SUNNY SURPRISE

HOW MUCH SOLAR HEAT COMES FROM THE SUN TO YOU?

FIRST, work each problem and find your answer in the rectangle below. Copy the letter of your answer in each square.

SECOND, when you finish you will have an important "Sunny Fact".

P 12% of 17 =

R 35% of 15 =

C 67% of 44 =

N 8% of 94 =

W 5% of 34 =

E 93% of 9 =

L 26% of 40 =

S 80% of 36 =

Q 9% of 114 =

T 6% of 35 =

M 20% of 16 =

I 79% of 175 =

U 38% of 95 =

O 7% of 669 =

A 4% of 59 =

B 3% of 2810 =

2.36	84.3	46.83	36.1	2.1		2.1	1.7	46.83		29.48	2.36	10.4	46.83	5.25	138.25	8.37
28.8		2.04	8.37	5.25		28.8	10.26	136.1	2.36	5.25	8.37		29.48	8.37	7.52	2.1
138.25	3.2	8.37	2.1	8.37	5.25		2.04	8.37	5.25		3.2	138.25	7.52	36.1	2.1	8.37

SUN CODE

SOLVE THE FOLLOWING PROBLEMS. YOU MAY HAVE TO REARRANGE SOME OF THE ELEMENTS IN EACH ANSWER IN ORDER TO MAKE THEM FORM A WORD.

1. $\{B, T, H, E\} \cap \{H, L, E, T\}$ = ____________

2. $\{T, E, S\} \cup \{S, T\}$ = ____________

3. $\{H, I, W\} \cup \{T, W, H\}$ = ____________

4. $A = \{B, M, A, R, P\}$
   $B = \{V, L, X, S, A\}$ $A \cap B$ = ____________

5. $\{R, A, U, E, T\} \cap \{E, T, I, U, R\}$ = ____________

6. $A = \{T, F, G, I\}$
   $B = \{F, T, G\}$ $A \cup B$ = ____________

7. $X = \{P, F, T, R, O\}$
   $Y = \{Z, O, H, J, F\}$ $X \cap Y$ = ____________

8. $\{U, E, Y, T, A\} \cup \{A, E, B, T\}$ = ____________

9. $A = \{A, S, R, I\}$
   $B = \{P, I, V, S, M\}$ $A \cap B$ = ____________

10. $\{H, C, T, E\} \cap \{E, P, H, T\}$ = ____________

11. $A = \{N, U, S\}$
    $B = \{U, S, N\}$ $A \cup B$ = ____________

12. $X = \{E, T, B, R, S\}$
    $Y = \{T, C, S, E, L\}$ $X \cap Y$ = ____________

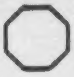
SHAPE UP

Choose the name of each geometric figure from the word bank below. Write the name in the spaces next to the figure. Some of the letters have numbers under them. Write these letters in the boxes below.

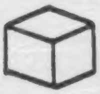
WORD BANK

ANGLE . . CIRCLE . . CONE . . CUBE . . CYLINDER . . DECAGON* . .

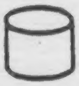
. . HEXAGON . . OCTAGON. . . PENTAGON . . SPHERE . . TRIANGLE . .



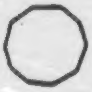
_ _ _ _ _ _ _ 1



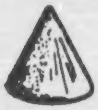
_ _ _ _ 2



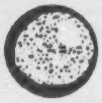
_ _ _ _ _ _ _ _ 3



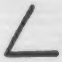
_ _ _ _ _ _ _ 4



_ _ _ _ 5



_ _ _ _ _ _ 6



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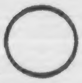

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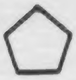
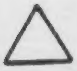
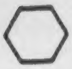


_ _ _ _ _ _ _ _ 9



_ _ _ _ _ _ _ _ 10



_ _ _ _ _ _ _ 11

10 9 4 2 1 9   7 8 11 10 9   11 5 4

☐☐☐☐☐☐   ☐☐☐☐☐   ☐☐☐

2 6 9   8 9 6 6   9 5 9 10 7 3

☐☐☐   ☐☐☐☐   ☐☐☐☐☐☐

ANSWER KEY

UNIT I

WHOLE NUMBERS

Sunny's Energy Line: A shower takes twelve gallons of hot water.

Sunny's Green Machines: Photosynthesis.

Find The Suns: 172; 4147; 3248; 6496; 2349; 899; 7395; 141288.

Sunny's Star: 232; 3416; 5815; 6619; 89; 183; 41; 9639; 5922; 89; 979; 28; 41; 89; 232.

Knock-Knock: Swarm - in winter in my solar house.

Solar Sunny: 10,485; 2682; 35046; 1,077, 598; 943; 470; 172,119,000; 3,091,191; 1810; 2519; 2191.

Sunny Message: The sun is the source of all life on earth.

FRACTIONS

Energy Under The Sun: One quad is equal to the amount of gasoline used by twelve million cars in one year - enough energy to heat one million homes for 10 years. Florida consumed two quads in 1980.

Ener-maze: 16 7/24; 14 7/15; 15 1/2; 10 1/4; 9 1/20; 8 3/14; 12 7/8; 6 11/18.

Singing In The Sunshine: Jump for Joy; Smile Bright - Everything is Sunny Bright Because your work is out of sight.

Star Light-Star Bright: (4/7; 5/8; 1/3; 2/3); (1/8; 14/15; 2/3; 8/9); (1/3; 1/8; 1/6; 2/9); (4/8; 8/9; 2/15; 1/6); (14/15; 2/9; 4/7; 2/15)

Fly Sunny: None if you are a bird.

Love Letters In The Sun: Hang around me a little bit longer.

Sunny Facts of Energy: Seven percent of the world's population uses thirty-three percent of the world's energy resources.

Sun-Miser: Solar water heater saves.

DECIMALS

Sunny Fact: Energy; earth's, energy, earth's

Energy Message: Electricity was a shocking discovery.

Star Sun: 12.5; 1.42; 2.51; .335; 70.42; 432.9; 68.853; 797.156; .335; 1.387; 1.596; 3.993; 34.023; 17.2; 36.55; 3.993; 699.4; 12.5

ANSWER KEY - UNIT I

DECIMALS (Continued)

Sound-Off For Energy: Turn off T.V. When Nobody Is Watching.

Sunny Rays: The solar water heater.

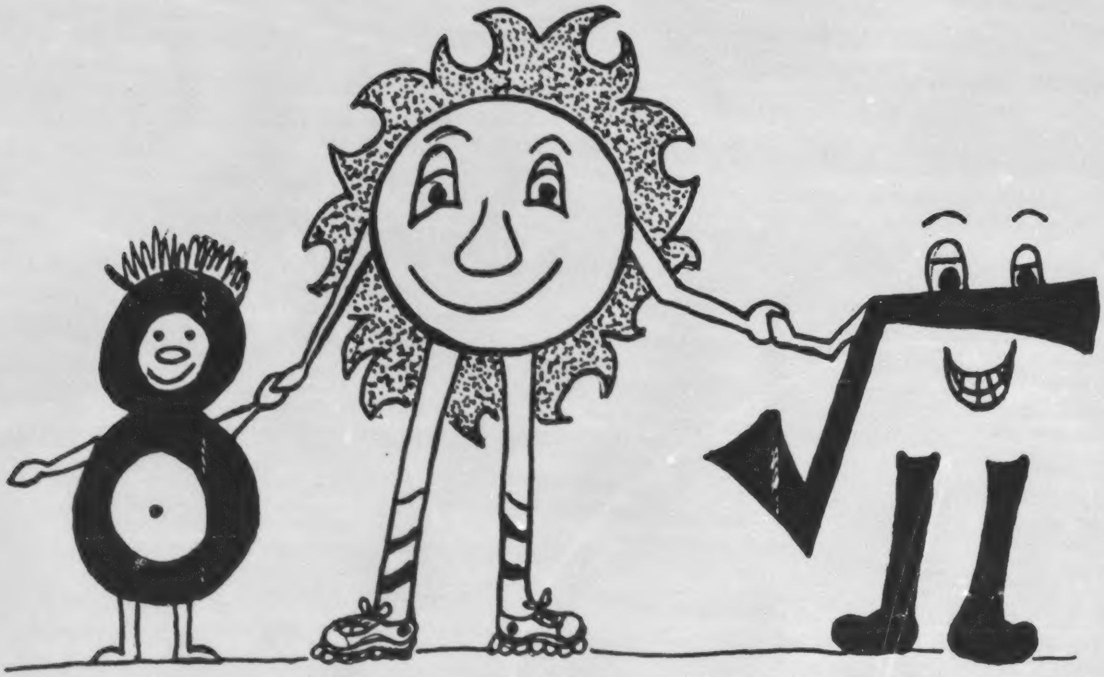
Sunny's Keeper: Two inches of insulation in the exterior walls of a house will reduce fuel consumption by 8 percent.

A Sunny Surprise: About two calories per square centimeter per minute.

MISCELLANEOUS

Set Notation: Sun Code; the set with a true gift of beauty is the sun set.

Geometry: Shape Up; Reduce glare and use less energy.



UNIT TWO

ENERGY BREAKERS

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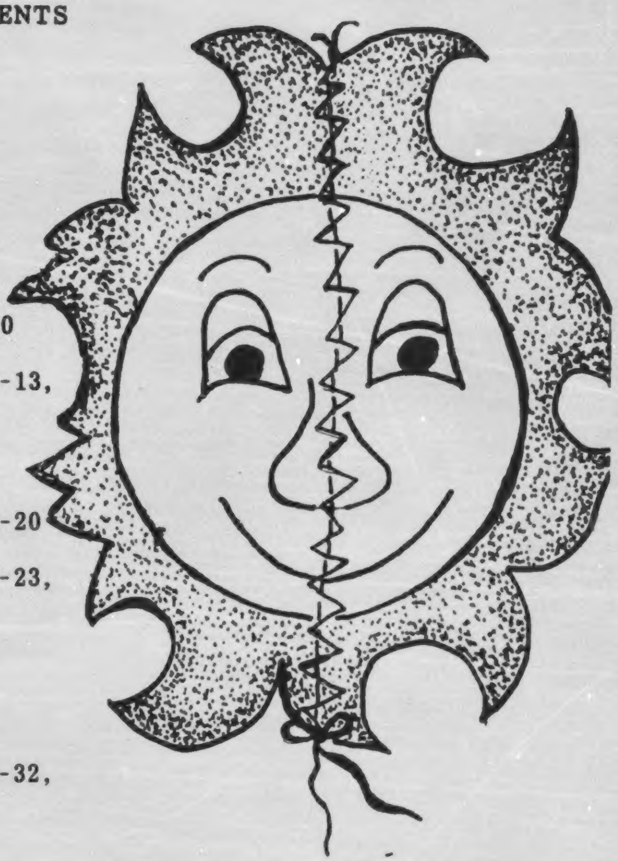


Teachers may wish to have these practical word problems copied and distributed to students for real life mathematical computation and reasoning.

Skills needed to solve these problems are listed at the beginning of each section.

SOLAR DAILY

The Newspaper for Sunny Days

EDITORIAL

Energy Crisis Real or Contrived?

In any one doubling period, more energy reserves are consumed than in all preceding history. The formula is $T_2 = \frac{70}{P}$, where T_2 = doubling time, 70 is constant and equals the percent of growth in a unit of time. If Seminole County's growth rate between 1979 and 1980 was 7%, what was the doubling time?

Solar Sunny's Problem Solver

It has been estimated that one square foot (1 $ft.^2$) of land can produce approximately 700 BTU of energy from biomass in one year. If your family needs are 42,000,000 BTU's a year, how much land does it take to supply your basic energy need?

Remember that this is the only energy you use each year. Your family can't buy a new car or even repair the old one with this amount of energy. No new Atari tapes or skateboards either. Making new items requires a tremendous amount of energy.

Sun-Tea

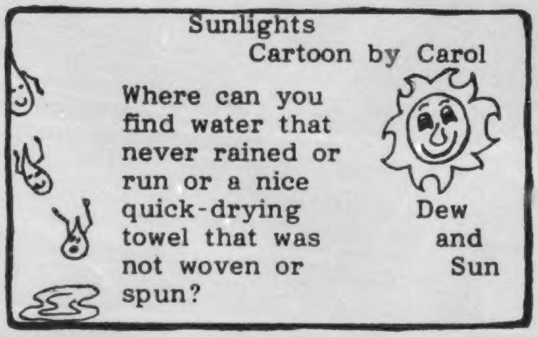
Recipe: 12 bags tea, 1 liter of tepid water.
Empty content of tea bag into 1-liter jar with lid; add water and stir briskly; screw lid on tight so jar won't leak, turn upside down. Set jar in sunny window and leave until liquid is as dark as strong coffee. How long does this take? Turn you jar several times as tea brews. Strain tea--then store in refrigerator.

To make a 200-ml. glass of ice-tea, pour 100-ml. Sun-Tea mix into a glass, add 5 ice cubes, fill with cold water. Enjoy your sun-tea.

How many 200-ml. servings will you get out of this recipe?

Homemaker Helper

If Mr. Sol's new solar heating and cooling system saves him $ .90 per day, how long would it take to pay for itself if it cost $2500 to install? The government reimburses Mr. Sol for 40% of his investment. Now how long is the pay-back period?



Sunlights
Cartoon by Carol

Where can you find water that never rained or run or a nice quick-drying towel that was not woven or spun?

Dew and Sun

Dear Sunny

Dear Sunny:

My father tells me to take a shower instead of a bath to save energy. Is he right?

Signed,
Hot Tub

Dear Hot Tub:

Yes, your father is right. An average shower required about 6100 BTU's to heat the water and 9000 BTU's for a tub-bath. This is almost 1/3 more.

SUPPLY AND DEMAND

Skills Needed:

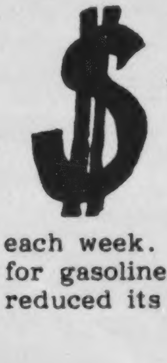
1. Multiplication of whole number and decimals using money.
1. Subtraction of whole numbers and decimals using money.

Finish the story by filling in the blanks. Think of the right answer. Then see if it appears in the answers below. Put its number in the blank. Some answers may be used more than once.

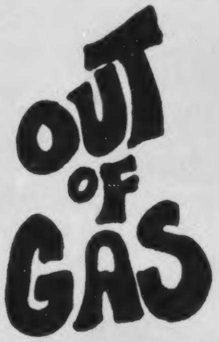
POSSIBLE ANSWERS

1. 40
2. lowered
3. supply
4. 200 gallons
5. $11.00
6. 5 gallons
7. shortage
8. raised
9. surplus
10. 160 gallons
11. demand
12. $220.00
13. $115.00
14. $5.75

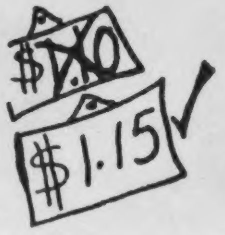
Mr. Sunny, a gasoline station owner, received 200 gallons of gasoline regularly each week. His 20 regular Smalltown customers were used to buying all the gas they needed. Although some weeks some people bought more and some bought less, average use was 10 gallons a week. The total demand for gasoline each week, then, was ____. As you have seen, Mr. Sunny's supply was ________. Everybody was pretty happy about the whole thing. The supply was equal to the _____.



Mr. Sunny charged $1.10 a gallon for gasoline, a price that was about the same as that charged by the other station in town. Each regular customer spent an average of _______ each week. Mr. Sunny received _____ for gasoline. When the other station reduced its price per gallon by a penny, four of Mr. Sunny's regular customers deserted him and went across the street. He was still getting a delivery of 200 gallons a week, but now the demand was only _____. He had ______gallons left over. This unbought quantity of gasoline is called a ______. To get rid of the surplus, Mr. Sunny ______ his price. His other regular customers bought up the ______ and took a few more pleasure trips into the city.



Several weeks later, Mr. Sunny and the other station each received only 100 gallons of gasoline. Their customers' demands were still the same, so the pumps soon became empty. "No More Gas!" the sign in front said. Halfway through the week, Mr. Sunny had a ____ of gasoline. By still charging $1.10 a gallon, he didn't make enough to pay the costs of his station.



The next week, he raised the price to $1.15 a gallon. Even at the higher price most of his customers had to buy gas to drive to work and do errands, so he sold all 100 gallons. How much money did he receive?_______.

_____What was the average amount each of the 20 regular customers spent?

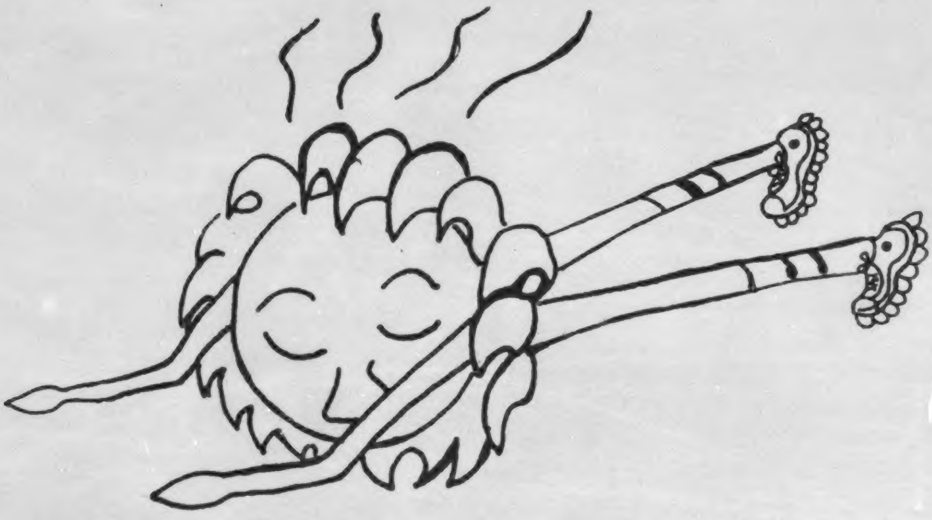
_____What was the average amount of gas each customer used?_____.

GAS FOR LESS
GAS

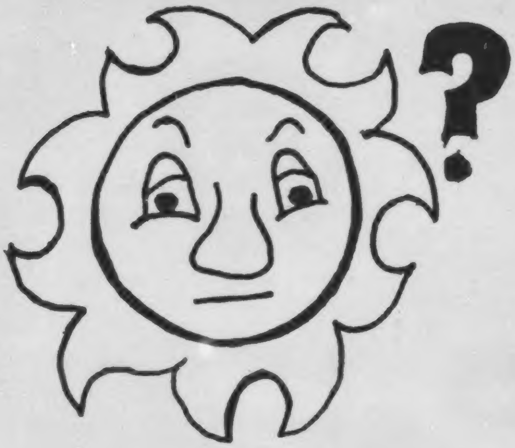
HELP!

Some of Mr. Sunny's customers were on a fixed budget and couldn't afford to spend more than $11.50 a week for gas. Some customers got to the station after the pumps were empty and couldn't get all they needed. Some of the other station's customers came over to Mr. Sunny's station. The demand was greater than the _____. Mr. Sunny _______his gasoline prices again.

Discuss in your class ways in which the people of Smalltown might solve their gasoline supply problem.



ENERGY-WELL



Skills Needed:

1. Whole Numbers
   a. multiplication
   b. subtraction
   c. division
2. Finding Percent of a Whole Number
3. Making a Circle Graph

PRACTICAL APPLICATIONS

1. The United States consumed 38 million barrels of oil per day in 1977. If each barrel of oil is equal to 42 gallons, how many gallons of oil were consumed each day?

2. If the refining plants can make 46% of each barrel of oil into gasoline, how many barrels of gasoline can be produced from 38 million barrels of oil? How many gallons of gasoline? (42 gallons per barrel)

3. The United States used approximately 36 million barrels of oil per day in 1973. How many barrels of oil did the U.S. use in all 365 days of 1973?

4. By doubling the miles per gallon for all passenger cars we would save 5 million barrels of oil per day. With a 20% increase in the miles per gallon, how many barrels would we conserve?

5. From 1967 to 1972, the cost for drilling an oil well increased from $82,000 to $105,000. What is the amount of increase?

6. The average cost for completing an offshore well in 1975 was $1,247,000 compared to $226,000 for an onshore well. How much more does it cost for offshore drilling?

7. In 1970, the known reserves of natural gas was 291 trillion cubic feet. The demand during that year was 18 trillion cubic feet. With the same rate of usage, about how many years would we have natural gas?

8. In 1977, the proved U.S. natural gas reserves totaled 216 trillion cubic feet, according to the American Gas Association. Assuming no new gas was discovered, how much gas was used between 1970 and 1977? What was the average used per year? (See problem 7)

9. In 1977, the U.S. Geological Survey estimated about three times as much more potential natural gas resources could be found. By how many cubic feet of gas would this increase our reserves? (See problem 8)

10. Existing fields produced 67 billion cubic feet per day (BCFD) of natural gas in 1973. The production is expected to decline to 39.4 BCFD by 1985. What is the amount of the daily decrease?

11. According to 1970 figures, the 63.4 million occupied U.S. dwellings were heated as follows:

Natural gas	55%
Oil	19%
Electricity	8%
Other	18%

a. Make a circle graph showing the above percent.
b. How many homes were heated by natural gas? By oil?
c. How many more homes were heated by natural gas than by oil?

12. It is estimated that 10% of the natural gas used in this country is burned by pilot lights. If the annual consumption of natural gas was 20.5 trillion cubic feet for 1978, how much was used by the pilot lights? If it were possible to save 4% of gas consumption by turning off the pilot lights for heating systems when not needed, how much gas could be saved (give answer in billion cubic feet)?

13. Each day the average American uses energy from 13.6 pounds of coal, 3.3 gallons of oil, 297 cubic feet of natural gas, 3.7 kilowatt hours of hydroelectric power, and 2 kilowatt hours of nuclear power. Using 365 days per year, how much of each is used in one year?

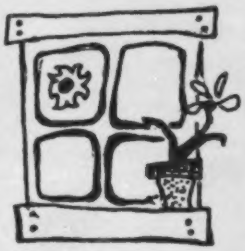
WRONG WELL !! (OH, WELL...)

INSULATE - THEN CELEBRATE!

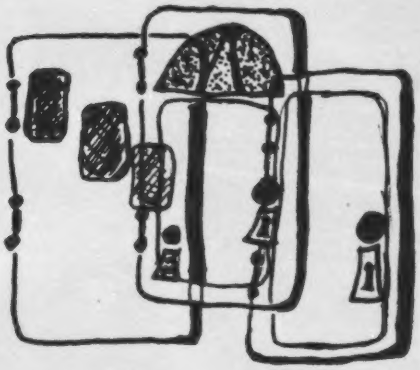
Skills Needed:
1. Decimals
   a) multiplication using money
   b) subtraction using money
2. Rounding to nearest hundredth
3. Find area of a rectangle
4. Find percentage of a given quantity
5. Cost comparison

The Pearson family of four was very concerned about the energy crisis existing in our country. At school, Richard and Melissa were studying ways to conserve energy. The family decided to make a project of insulating and weatherizing their home.

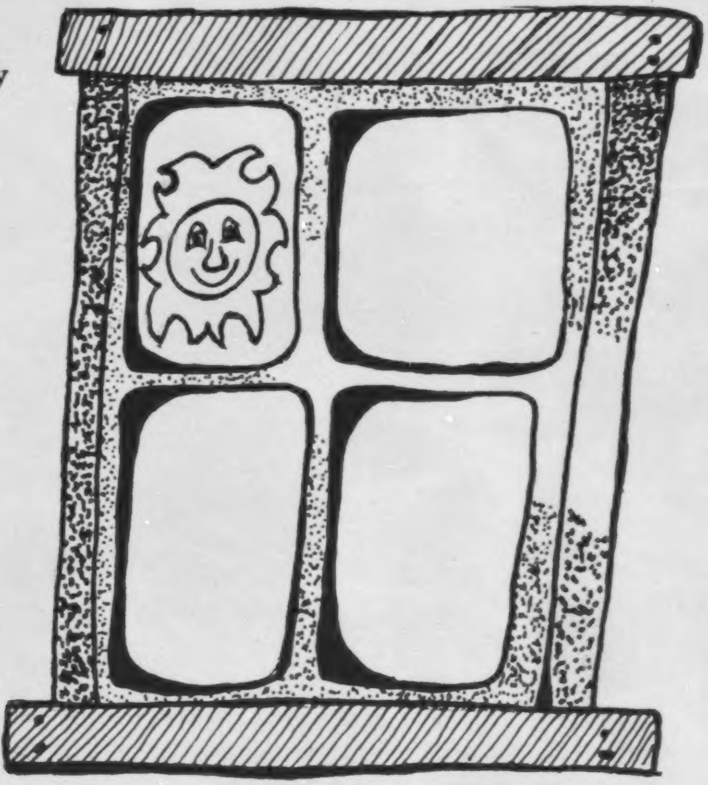
1. Mrs. Pearson checked all the windows in the home to see if the caulking and weather stripping were satisfactory. She found 15 windows needed caulking and $4.00 for weather stripping. If it cost $0.90 per window for caulking and $4.00 for weather stripping, how much did it cost to weatherize the windows?



2. Melissa examined their three outside doors. One door needed weather stripping and two needed caulking. If the cost is $7.75 to weatherstrip a door and $0.85 to caulk each door, how much money is needed?
3. The Pearsons felt buying storm windows would be too expensive at this time. Instead they purchased polyethylene plastic at $0.65 per roll. If it takes one roll per window, how much did it cost for 18 windows?
4. Mr. Pearson and Richard planned to insulate the attic. First, they had to calculate the area. They measured the largest section of their U-shaped home and found it to be 30' by 50'; the other two sections were 8' by 12'. What is the area of the attic?



5. The insulation needed for the attic was R-2 at a cost of $0.28 per square foot. The Pearsons paid ___________ to insulate the attic.
6. Since the Pearsons' home is brick, they decided not to insulate the walls at this time. They did feel they could conserve energy by insulating the floors. Without doing any computations, what was the area of the floor?
7. If the cost for floor insulation is $0.12 per square foot, how much did the Pearsons spend for floor insulation?
8. What was the total amount the Pearsons spent to insulate and weatherize their home?
9. By doing the work themselves, the Pearsons felt they saved about one-half of what the bill would have cost if they had hired a contractor to do the work. How much did they save?
10. Mr. Pearson purchased materials during 1974. What amount will he be able to deduct on his income tax?
11. The Pearson's utility bill for heating and air conditioning had been $750. By insulating and weatherizing, they expect to save about 30%. How much is their savings?



WATT'S HAPPENING?

Skills Needed:
1. Whole Numbers:
   - a. addition
   - b. subtraction
   - c. multiplication
   - d. division
2. Fractions:
   multiplication

Electrical energy is important in Florida. The President of the United States has asked all Americans to help conserve energy. In understanding how to read meters and convert watts to watt hours to kilowatt hours we can become more conscious of how much electricity we use.

Changing From Watts to Watt Hours

The watt (W) is a unit of measure used in electricity and is defined as the rate at which the electric current is being used or consumed. Watt hour (Wh) is the product of the watts and the time used (in hours). For example a 75 watt light bulb burning for 3 hours would use 225 watt hours. (75 W x 3 h = 225 Wh). You will find stamped on the light bulb the number of watts of each bulb. Most all electrical appliances state the number of watts they use.

Example: How many watt hours of current would a 60 watt bulb use in 20 minutes a day for 7 days?

Solution: 20 min. = $\frac{20}{60} = \frac{1}{3}$ h $\quad 60 \times \frac{1}{3} \times 7 = 140$ Wh

1. Joan has an electric hair dryer which uses 1200 watts. If she uses it for 15 minutes a day for 30 days, how many watt hours will she use (a) a day? (b) 30 days?

2. Mrs. Walker uses a 1500 watt vacuum cleaner on the average of 45 minutes a day. How many watt hours will she use (a) a day? (b) a week? (c) 30 days?

3. Joey watches the television 4 hours a day, 7 days a week. The set uses 700 watts. How many watt hours does it use in (a) a day? (b) 7 days? (c) 30 days?

4. William uses his radio about 1 hour and 45 minutes a day. If the radio uses 250 watts, how many watt hours does it use (a) a day? (b) 7 days? (c) 30 days?

5. (a) Mrs. Jackson estimates that to do the laundry each week she uses an average of 2 hours for washing, 3 hours and 15 minutes for drying, 1 hour and 45 minutes for ironing. How many watt hours does she use if the washer uses 200 watts, the dryer uses 6000 watts and the iron uses 1200 watts? (b) If Mrs. Jackson hung her clothes out to dry in the sun instead of using her dryer, how much electricity would she save?

6. A regular oven will bake a potato in 1 hour and uses 8000 watts. A microwave oven will do the same job in 5 minutes and uses 600 watts each hour. How many watt hours would be saved by using a microwave oven?

7. Mrs. Moore's dishwasher uses 1500 watts and she runs the dishwasher for 45 minutes each day. The drying cycle uses 15 minutes of this time. If she opens the door while the dishes are drying and lets them air dry, how many watt hours would she save (a) each day? (b) a year (365 days)?

8. A hot water heater uses 4500 watts each hour of use and runs an average of 15 minutes per hour.
   (a) How many watt hours is this for one day (24 hours)?
   (b) If the current were cut off for 8 hours while the family is away at school and work, how many watt hours would be saved (1) a day? (2) 5 days?
   (c) If the current were turned off for 6 hours at night while the family is sleeping, what would be the total saved during the day and night (1) per 24 hours? (2) a week? (3) 30 days? (4) a year (365 days)?

Converting from Watt Hours to Kilowatt Hours

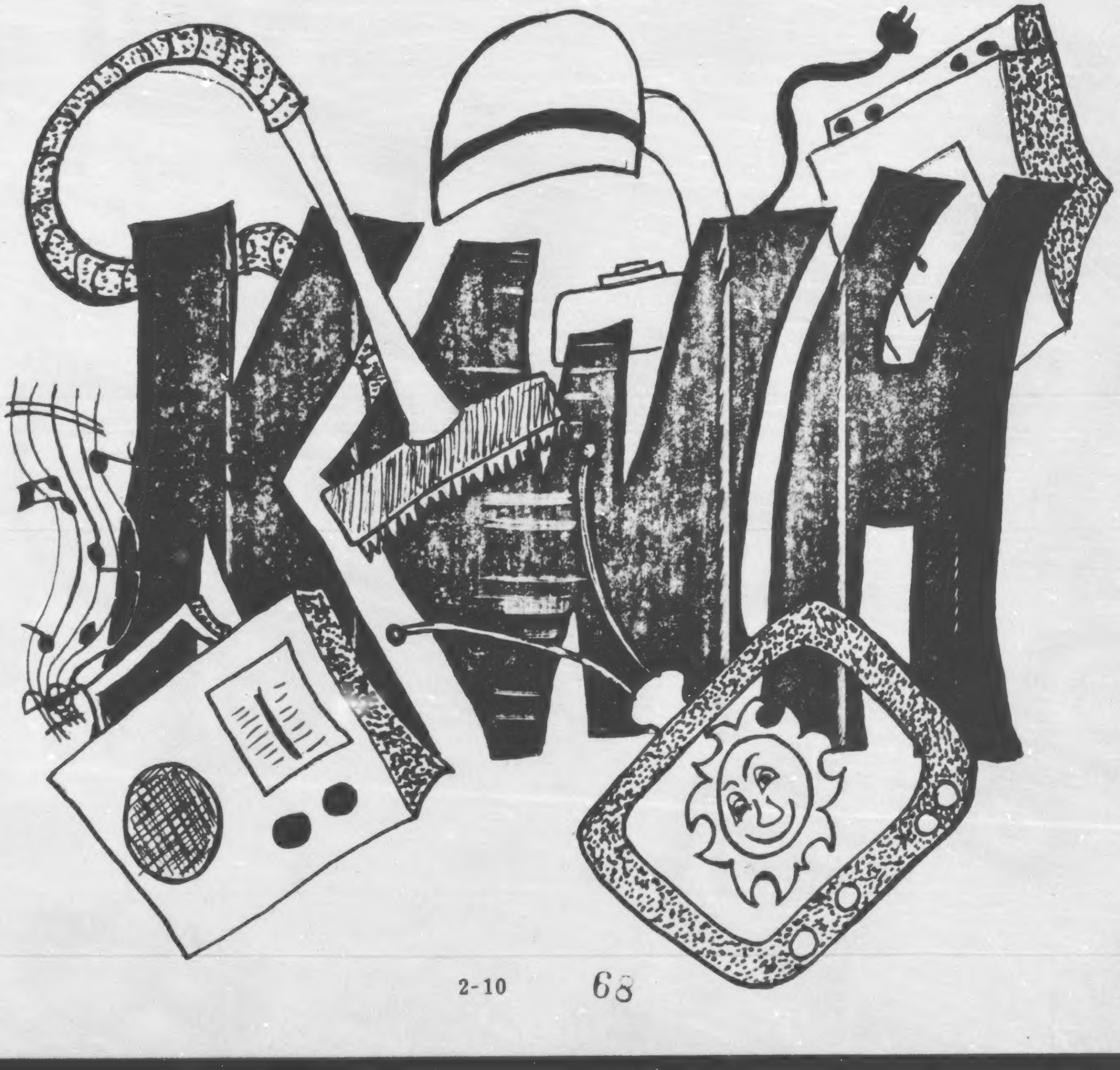
Since the watt hour is a small quantity of measure, a larger unit is needed in computing large usage of current. This unit is called a kilowatt hour (kWh). One kWh is equal to 1000 watt hours (Wh). To change from watt hours to kilowatt hours you divide the number of Wh by 1000. When dividing by 1000 remember to move the decimal point 3 places to the left.

Example: 1500 Wh equals how many kWh?

Solution: 1500 Wh ÷ 1000 = 2.5 kWh
1500 ÷ 1000 = 1.500 kWh

Change the following watt hours to kilowatt hours.

1. 21600 Wh = ________kWh
2. 7700 Wh = ________kWh
3. 3400 Wh = ________kWh
4. 15000 Wh = ________kWh
5. 4 Wh = ________kWh
6. 200 Wh = ________kWh
7. 42 Wh = ________kWh
8. 290 Wh = ________kWh
9. 16 Wh = ________kWh
10. 1.7 Wh = ________kWh



WORK OUT YOUR ENERGY

Skills needed:

1. Multiplication and division of whole numbers
2. Finding percentage
3. Solving simple equations
4. Determine percent of increase-decrease
5. Cost comparison
6. Using tables to solve word problems

It is not simple to define energy in a way that is easily understood by people not trained in science. The most frequently used definition of energy is the ability to do work. But what is work?

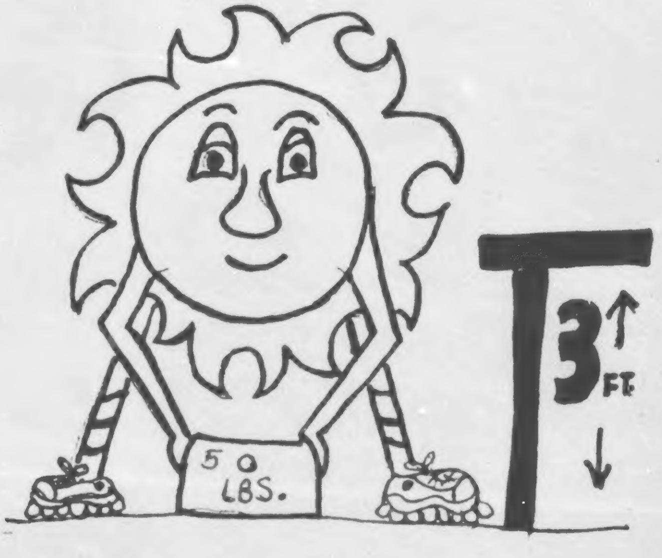
Work implies accomplishing something. No work is ever done without, in one way or another, involving motion. Something has to be moved to accomplish work. To measure how much work is done, two things have to be considered: (1) the force (push or pull) needed to move the object; and (2) the distance that this object is moved. This can be put in the form of a mathematical equation:

$$\text{Work} = \text{Force} \times \text{Distance}$$

$$W = F \times D$$

SAMPLE PROBLEM

How much work is done when a 50 pound box is lifted from the floor to the top of a table which is 3 feet above the floor?



SOLUTION:

To lift the 50 pound box you would have to apply an upward force of 50 pounds. So the force (F) is 50 pounds and the distance (D) the force must act is 3 feet.

W = F x D
W = 50 pounds x 3 feet
W = 150 foot-pounds (ANSWER)

As you can see, the unit for work is foot-pounds (ft.-lbs.)

Let us do the same problem using the metric system!

SAMPLE PROBLEM

Fifty pounds equals about 22.7 kilograms and 3 feet is about 0.91 meters. Therefore the work done is:

W = F x D
W = 22.7 kilograms x 0.91 meters
W = 20.66 kilogram-meters (ANSWER)

NOTE: For convenience we shall use the units kilogram for force and kilogram-meters for work. Actually, the unit for force in the metric system is the newton, and the unit for work is joule.

1. Suppose the weights of your textbooks are as follows:

Mathematics:	0.9 kg
Science:	1.1 kg
Social Studies:	1.3 kg
English:	2.0 kg

Determine the amount of work required (kilogram-meters) to move these four books from the floor to the top of a desk 70 cm high.

2. The rungs on a vertical ladder used to reach the top of a 150-foot high water tower are one foot apart. Calculate the work (foot-pounds) required for a 200-pound man to climb a total of:
    a. 15 rungs
    b. 45 rungs
    c. 150 rungs

3. Compute the force required to lift a 20-foot boat weighing 2,500 pounds to a height of 8 feet.

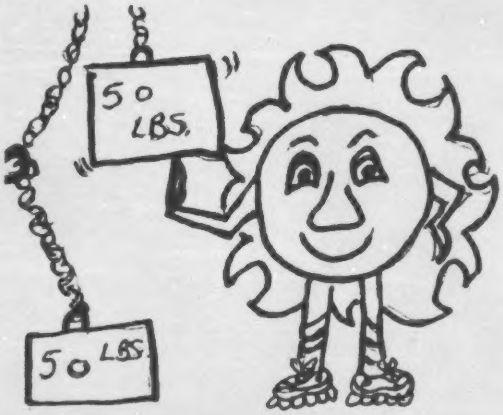
Since energy is the ability to do work, the amount of energy used maybe equal to the amount of work done. Therefore, the units of measurement for energy are the same as the units for work - that is, foot-pounds in the customary system and kilogram-meters in the metric system.

How much energy is used to do the following things:

4. With a force of 12 pounds pull a wagon a distance of 5 feet?

5. Lift a bag of cement weighing 45.5 kilograms to the top of a wall which is 1.2 meters high?

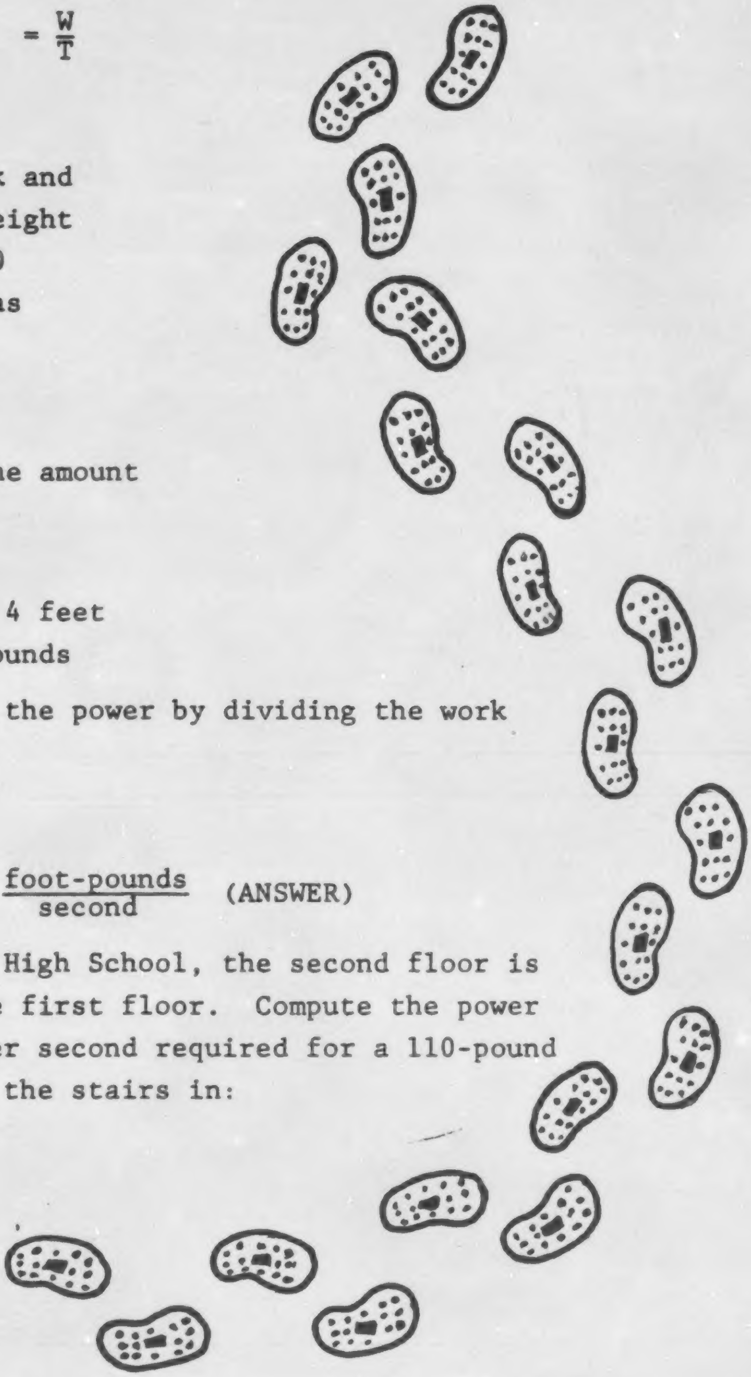
To conserve energy it is evident that you must accomplish something with the minimum amount of work. This principle was discovered many years ago when people first invented the wheel. They discovered it required less force, and, consequently, less work, to roll something than to drag it. In the process of doing work, the less resistance or friction you work against, the less energy you will expend.


50 LBS.
50 LBS.

Power can be measured mathematically by dividing the amount of work done by the time it took to do it.

$$\text{Power} = \frac{\text{Work}}{\text{Time}}$$

$$P = \frac{W}{T}$$



SAMPLE PROBLEM

A person using a block and tackle lifts a 300-pound weight to a height of 4 feet in 40 seconds. How much power was applied?

SOLUTION:

First you must find the amount of work accomplished.

$$W = F \times D$$

$$W = 300 \text{ pounds} \times 4 \text{ feet}$$

$$W = 1{,}200 \text{ foot-pounds}$$

Now you can calculate the power by dividing the work done by the time.

$$P = \frac{W}{t}$$

$$P = \frac{1{,}200}{40} = 30 \ \frac{\text{foot-pounds}}{\text{second}} \quad \text{(ANSWER)}$$

6. At Coral Springs High School, the second floor is 18 feet above the first floor. Compute the power in foot-pounds per second required for a 110-pound student to climb the stairs in:
   - a. 30 seconds
   - b. 20 seconds
   - c. 10 seconds.

7. A rope hanging from the ceiling of a gymnasium is 9 meters long. Calculate the power in kilogram-meters per second required for an athlete weighing 68 kg to climb the rope in:
   a. 1 minute
   b. 45 seconds
   c. 1/2 minute
   d. 15 seconds

8. If 60 foot-pounds per second of power is required to do a certain task, determine the power required to do the same task in:
   a. 1/2 the time
   b. 1/3 the time
   c. 1/4 the time

You are probably familiar with the word horsepower used to describe the power of engines. One horsepower simply means doing work at the rate of 550 foot-pounds per second. Therefore, a 10-horsepower outboard motor can do 550 x 10 = 5,500 foct-pounds of work in one second.

9. Convert the following measure events of power to horsepower:
   a. 3,850 foot-pounds per second
   b. 8,250 foot-pounds per second
   c. 27,500 foot-pounds per second

10. Determine the number of foot-pounds per second of power generated by the following engines:
    a. 2 1/2 H.P. lawnmower
    b. 55 H.P. outboard
    c. 130 H.P. inboard
    d. 225 H.P. automobile

ENERGY I$ MONEY

Skills Needed:
1. Decimals
    a. multiplication using money
    b. subtraction using money
2. Construct bar graph
3. Finding percent of a number
4. Finding total given percent and percentage of a number
5. Fractions:
    multiplication

ELECTRIC AND GAS ENERGY USE (ANNUALLY)

	ELECTRICITY	COST	NATURAL GAS	COST
Water Heater	4200	______	14340	______
Range	1200	______	4100	______
Clothes dryer	1000	______	3410	______
Refrigerator (Frostless)	1800	______	6140	______

1. a. If the cost of natural gas is $2.44 per 1000 cubic feet, how much does it cost the average family to run the water heater for a year? The range? The clothes dryer? The refrigerator? (Complete the table.)

    b. If the cost of 1 kWh is $0.072, complete the table:

2. Make a bar graph comparing the cost of electricity and natural gas for the above appliances.

3. How much more does it cost to run the hot water heater than the clothes dryer?

4. The Pritchett family wanted to cut their natural gas usage by 15% on their water heater, range, and clothes dryer. By how many cubic feet per year would they reduce their yearly usage?

5. The Seminole Gas Corporation supplies about 25% of Orlando's natural gas If this amounts to one billion cubic feet, how many cubic feet does the Seminole Gas Corporation provide?

6. To finance the new pipeline needed to supply the natural gas, bonds were issued for two-thirds of the $3,000,000 project. What amount of bonds were sold?

7. Because of increased expenses, residential gas customers' rates were increased by 5%. If Ms. Mitchell's gas bill was $34 last January, what can she expect to pay this January (the first month of increase)?

8. The Wilson family of four has a monthly net income of $1200. The energy used to heat their home comes from natural gas. If they spend 1/30 of their income for heat, how much do they spend monthly? Yearly?

BILL FOR NATURAL GAS
TOTAL $

ENER-MATH

Skills Needed:
1. Whole Numbers
   - a. multiplication
   - b. subtraction
   - c. division
2. Finding percentage, percent, total
3. Finding average
4. Finding percent of increase
5. Make a bar graph

Practical Applications:

1. Sallie has a hair dryer which uses 1200 watts. If she uses it 25 minutes each day:
   - a. How many watt hours does the dryer use?
   - b. How many kilowatt hours?
   - c. If the electric rate is .07¢ per kilowatt hour, how much does it cost her to run her hair dryer each day? Seven days?
2. Insulation of a home decreases the heating bill approximately 20%. How much was Mr. Powers' bill prior to insulating his home if his present bill is $400.00 per year?
3. Johnny has a Chevette and can drive 286 miles on one tank of gasoline. If the tank holds 11 gallons of gasoline, how many miles per gallon does Johnny's car average?
4. Mr. Pratt installed a solar heating system in his present house. If he paid $2079 and he saves $247 each year on heating and cooling:
   - a. What percent of his cost is savings?
   - b. How long will it take for the new system to pay for itself?
5. The Seminole Natural Gas Corporation increased the residential customer's rates by 15%. If Ms. Allen's bill was $45.00 in January, how much might her next bill be?
6. In 1978, the United States used 623 million tons of coal. How many tons of coal was used per day (365 days per year?)

7. Mr. Drake's electric meter read 15672 for the month of June. For July it read 17754.
   a. How many kilowatts did he use?
   b. If the electric rate in his city is seven cents per kilowatt hour, what was his electric bill?

8. Each barrel of oil is equal to 42 gallons. Last year, the U.S. consumed 36 million barrels of oil per day, how many gallons of oil were used per day?

9. If one ton of dry biomass can be processed to yield the equivalent energy of 1.25 barrels of oil, 1200 ft.^{3} of medium Btu gas, or 750 pounds equivalent of coal, what would be the savings of each with five tons of biomass?
   a. Oil ____________bbl
   b. Gas ____________ft^3
   c. Coal ____________lbs

10. Complete insulation of one-third of the existing U.S. homes would save about 50,000,000,000,000 Btus. If there are approximately 70 million homes, how many homes should have complete insulation in order to save the above Btus?

11. The average miles per gallon of gasoline for one car is 17.5, while another car gets an average of 20.5 mpg of gasoline. Find the percent of increase.

12. Ms. Cagle has an all electric home. If her air conditioner uses 12% of all the electricity consumed in the home and her electric bill was $112, how much of the bill was for the air conditioner?

13. In 1976, the known reserves of natural gas were around 266 trillion cubic feet. If the supply will last 13 more years at present usage, how many cubic feet were used for that year?

14. By doubling the mpg for all passenger cars, we would save 5 million barrels of oil per day. With a 15% increase in the mpg, how many barrels would we conserve?

15. The Tennessee Valley Authority bought coal in 1970 for $4.50 a ton. If 40 million tons of coal were purchased, what was the total cost for coal?

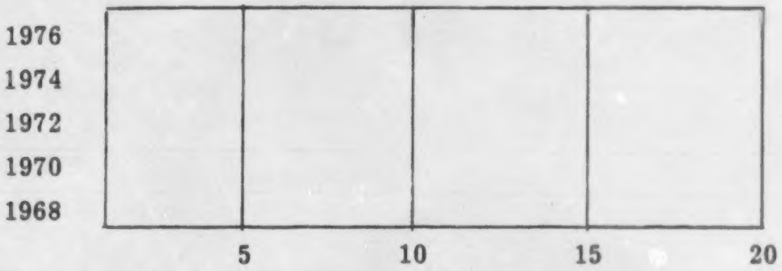
16. The area of Mr. Roberts' attic is 1800 square feet. If R-22 insulation cost $0.26 per square foot, how much would it cost him to insulate the attic?

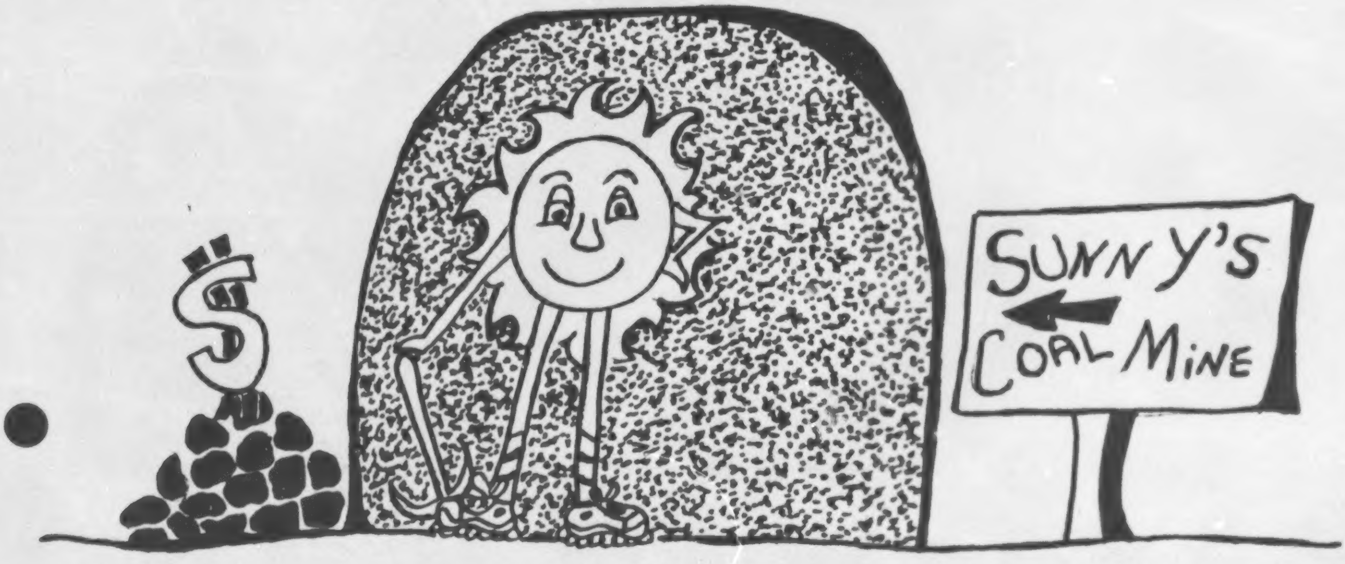
17. Twenty percent of all energy used is for home use. If an electric range uses 5% of home energy, how much of the total energy does the range use?

18. Make a bar graph in the space below to show the average cost of coal used by the TVA.

AVERAGE COST OF COAL BURNED

Year	1968	1970	1972	1974	1976
Cost Per Ton	$4.00	$4.50	$7.00	$8.00	$18.00





GASOLINE: A NECESSARY EVIL?

Skills Needed:

1. Whole Numbers:
   - a. addition
   - b. subtraction
   - c. multiplication
   - d. division
2. Ratio and proportion
3. Rounding off
4. Fractions to lowest terms
5. Decimals
   - a. multiplication
   - b. division
   - c. subtraction
6. Percent of increase
7. Cost comparison

The consumer is faced with many problems pertaining to gasoline. First, there are taxes placed on gasoline by the different levels of government. Also, with the price of gasoline increasing at an alarming rate, the public is becoming more aware of the efficiency of cars and the money it takes to buy and maintain one. Due to short supplies of gasoline and to inflation, the cost of gasoline will present more problems in the near future.

(Prices for gasoline were rounded off to the nearest cent.)

1. Susan lives in Huntsville, Alabama where the tax on each gallon of gasoline is: 7¢ federal tax, 7¢ state tax, 3¢ county tax, and 1¢ city tax. What is the total tax on gasoline?

2. If Susan's mother pays $1.30 (including tax) for a gallon of gasoline in Huntsville, the total tax (see #1) is what fractional part of the total cost of the gasoline (including tax)?

3. Laura can travel 378 miles on one tank of gasoline in her compact car. If the tank holds 12 gallons of gasoline, how many miles per gallon, to the nearest tenth, will she get from her car.

4. The overall efficiency of a car is measured in miles per gallon (mpg). The national average was 15.6 mpg in 1975 and improved to 17.6 mpg in 1976. Find the percent of increase.

5. If a 3% increase in new car economy, between 1974 and 1980, is equivalent to a saving of 51,750 barrels of oil per day, how many barrels will be saved if the new car economy is increased 15%?

6. Terry's family of four has a monthly income of $1200. They have a $150. car payment each month and they budget $85. per month for oil and gasoline for the car. What fractional part of the monthly income is spent on the car? What fractional part of the monthly income is spent on energy fuels? (Fractions should be written in simplest form.)

7. John is going to make a 600 mile trip. He needs to know how much money to take in order to pay for the gasoline his car will use. He knows his car gets 30 mpg and that the cost of gasoline will average $1.30 per gallon. How much money should John take to pay for the gasoline?

Conserve Gasoline With Proper Car Speed

With automobiles the greatest consumption of fuel occurs at high speeds or very rapid acceleration. Most automobiles get about 28 percent better gasoline mileage at 50 miles per hour than at 70 miles per hour. An automobile traveling at 55 miles per hour gets about 21 percent better gasoline than when traveling at 70 miles per hour.

(Prices for gasoline were rounded off to the nearest cent.)

8. A car traveling at 50 mph averages 19.5 mpg. The same car traveling at 60 mph averages 17.5 mpg. The car travels 600 miles in one day.
   a. How much fuel will it use at 50 mph? at 60 mph?
   b. If gasoline costs $1.30 per gallon, how much would it cost to travel the 600 miles at 50 mph? at 60 mph?
   c. How much money would one save driving at 50 mph for 600 miles rather than at 60 mph for 600 miles?

9. Suppose you wish to make a round trip from Orlando, Florida, to Clearwater, Florida, a total distance of 200 miles. The following numbers of miles per gallon in relation to three different speeds were calculated from previous records:

19 mpg --- 40 mph
17 mpg --- 55 mph
9 mpg --- 70 mph (an illegal speed)

a. Compute the driving time it would take to make the round trip, assuming a constant rate of:
   1. 40 mph
   2. 55 mph
   3. 70 mph (an illegal speed)

b. Calculate the number of gallons, to the nearest tenth, of gasoline you would use making the trip at the following constant speeds:
   1. 40 mph
   2. 55 mph
   3. 70 mph (an illegal speed)

c. Assuming a price of $1.30 per gallon of gasoline, compute the cost for gasoline to make the trip at the following constant rate of speed:
   1. 40 mph
   2. 55 mph
   3. 70 mph (an illegal speed)

10. Two cities, A and B, are 500 miles apart. A trucking company is under contract to deliver goods from A to B and from B to A.

500 miles
A
B

a. If a truck driver receives $15 per hour, how much would he earn at 65 mph and at 55 mph respectively for the round trip (1000 miles)? (Carry the division 2 decimal places.)

b. What is the increased cost in wages to the company resulting from the lower speed limit?

c. At 65 mph, a truck gets 6.2 mpg and at 55 mph the same truck gets 7 mpg. What is the cost of diesel fuel at the two rates for the round trip if diesel fuel cost $1.40 per gallon?

d. What is the decrease in cost of diesel fuel to the company by traveling 55 mph?

e. What is the overall impact of the decreased speed limit on the company? on the truck driver?

f. How did the decreased speed limit affect the amount of energy used?

Save Gasoline By Having Less Car Resistance

To conserve energy it is evident that you must accomplish a task with the minimum amount of work. This principle was discovered many years ago when people first invented the round wheel. They discovered that the task required less force and, therefore, less work to roll an object than to drag it. In the process of doing work, the less resistance or fraction you have to work against, the less amount of energy you will use.

11. Suppose your car averages 25 miles per gallon (mpg) of gasoline on long trips when the suitcases are on a luggage rack on top of the car. By putting the luggage inside the car (reducing the resistance) you get 8% better gasoline mileage.
    a. compute the mpg your car would obtain with the luggage inside the car.
    b. compute from Winter Park, Florida to Key West, (350 miles) with the luggage:
        1. on top of the car.
        2. inside the car.
    c. assuming a price of $1.30 per gallon for gasoline, determine the gasoline cost with the luggage:
        1. on top of the car.
        2. inside the car.
    d. determine the money you would save by packing the luggage inside the car instead of on the roof on your trip to Key West.

12. Under-inflated tires create a loss in gasoline mileage of up to 10%. Suppose your compact car averages 33 mpg with properly inflated tires and you travel 14,000 miles each year,
    a. determine the number of gallons of gasoline you would use with properly inflated tires (nearest tenth of a gallon).
    b. assuming your tires were under-inflated, causing an 8% loss in mileage, compute the number of miles per gallon you would obtain (nearest tenth).
    c. determine the number of gallons of gasoline you would use with improperly inflated tires during the year (nearest tenth).
    d. at $1.30 per gallon, compute the money you would save by having properly inflated tires.

13. Pulling a trailer with an automobile will always result in a decrease in gas mileage because of the added weight and resistance. Some trailers are streamlined in design to minimize this loss of efficiency but others are not. A certain streamlined trailer has been found to cause gas mileage to be reduced by 21%. Another trailer of about the same size and weight, but not streamlined, has been found to reduce gas mileage by 37%. When your car is not pulling a trailer it averages 16 mpg. Compute, to the nearest tenth, the number of gallons of gasoline you would use round-trip from Milton to Ft. Lauderdale, a trip of 620 miles when pulling:

   a. the unstreamlined trailer.

   b. the streamlined trailer.

14. Find the savings in the cost of gasoline by using a streamlined trailer for the trip in Exercise 13 if gasoline costs an average of $1.30 per gallon.

SPEED
LiMiT
55
SPEED
LiMiT
'70

CALCULATIONS WITH BIOMASS

Skills Needed:
1. Ratio and proportion
2. Multiplication of whole numbers
3. Finding percent of a number
4. Finding percent of increase
5. Multiplication of decimals using money

Organic material represents an important fuel source for the future. Conversion plants will need pollution control devices, but generally their contribution to pollution would be lower than that of the fossil fuels we are now using. Furthermore, the conversion of industrial and muncipal waste would reduce the serious disposal problems which we now face and which grow greater each day. The combination of reducing waste and waste conversion offer important future energy savings.

1. A pound of dry plant tissue can be burned to produce as much as 7500 Btus. An acre of sugarcane can yield 10 tons of dry plant tissue. This is equivalent to how many Btus?
2. Kelp farming, on open-ocean rafts near San Diego, California, is being studied for use in conversion to methane gas. A square of ocean area about 470 miles on each side could produce enough gas to have met the 1980 demands of the United States. Find the number of square miles in this area.
3. One problem with growing trees for energy is the large amount of water needed. One pound of dry wood needs about 72 gallons of water during its growing period. One hundred pounds of dry wood requires how many gallons of water?
4. An acre of corn will produce about 6 tons of dry organic material. By comparison, sunflowers can yield about 15 tons. This is an increase of what percent?
5. Water hyacinths, an expensive nuisance in Florida waterways, have been used for fuel. They have a productivity of about 80 tons of dry matter per acre per year. An experiment conducted by NASA, where hyacinths were grown in sewage water, produced about 220 tons of dry matter per acre. This is an increase of what percent?

6. Last year the amount of waste generated by one city was 100 million tons. The expected amount for 1990 is 222 million tons. What is the expected percent of increase?

7. The cost of collecting and disposing of this urban waste was about $3.5 billion. The following year the cost increased by 6 percent. What was the total cost the following year?

8. The energy potential of 135 million tons of waste is equivalent to 150 million barrels of oil. If oil sells for $40 a barrel, what is the value of this waste in terms of oil equivalents?

9. Corn can be used to make ethanol, a fuel very similar to gasoline. It is commonly known as gasohol. A bushel of corn yields about 2.6 gallons of ethanol. Last year Florida grew 500,000 acres of corn with an average yield of 60 bushels per acre.

   a. How many bushels of corn did Florida produce?
   b. If all this corn was converted to ethanol, how many gallons would be produced?
   c. Last year Florida used 4.8 billion gallons of gasoline. What percentage of this gas would the ethanol displace?
   d. What would happen to the price of eggs, chicken, and pork if Florida used all its corn to produce ethanol to burn in cars?

ENERGY AT HOME: CONSERVATION AND SOLAR ENERGY

Skills Needed:
1. Determine percent of increase-decrease
2. Multiplication of decimals using money
3. Find percentage
4. Division of whole numbers and decimals
5. Reading and writing large numerals

Proper home insulation can increase temperature-control efficiency by as much as 25%. Caulking and weather stripping windows and doors, a good do-it-yourself project, can reduce costs by 10% and add to the comfort of your home.

Storm windows can be permanently installed and even clear plastic film taped inside window frames can be very effective.

Installation of mineral wool, glass fiber, or cellulose insulation to a depth of six inches in the attic can reduce heating costs by 20%.

Problems

1. It has been estimated that if every home were caulked and weather-stripped we would save 580,000 barrels of home heating fuel.
   a. If each barrel is worth $40, how much would the savings be in dollars?
   b. Name this number.
2. The installation of storm windows can decrease the fuel costs for heating and cooling a home by 10%. Mr. Wickman installed 12 storm windows.
   a. If each window cost $15.99, how much did 12 cost?
   b. If his bill for heating and cooling his home for the year was $700, how much would the storm windows save each year?
   c. At this rate, in how many years will the storm windows pay for themselves (years and months)?

Congress has provided incentives to encourage energy conservation. Income tax credit, 15% of the first $2000, can be claimed by Mr. Wickman for the cost of the storm windows.

   d. How much can he claim as an income tax credit for his purchase of the storm windows?
   e. By subtracting his income tax credit from the cost of the storm windows, in how many years will the storm windows pay for themselves?

3. Mr. Conserton found that his attic had only two inches of insulation. He added four more inches of insulation, an increase of what percent?

4. If 15 million homes with inadequate attic insulation were upgraded, about 400,000 barrels of heating oil would be saved each winter day.
   a. How many barrels is this a month (30 days)? Give a word name for this number.
   b. If each barrel = 42 gallons, how many gallons of oil would be saved? Give a word name for this number.
   c. If each gallon of fuel oil = 140,000 Btus, how many Btus is this? Give a word name for this number.

5. Mr. Kermit installed a solar heating and cooling system in his home. It saves him 85 cents per day over his old system. How much does he save per year (365 days?)

6. If Mr. Baker's new solar heating and cooling system saves him 90 cents per day, how long would it take to pay for itself if it cost $2,500 to install?

7. If a solar hot water heater collects 10.5 million BTU's and stores 9 million BTU's, how many BTU's are lost in storing? Give a word name for this number.

8. If a solar hot water heater delivers from storage 7.7 million BTU's of what is collected but can only use 6.4 million, what percent is lost? Identify some ways this loss can be reduced.

9. If a typical home with a roof area of 1,600 square feet receives 2,000,000,000 calories of solar energy in a year, how large an area would be needed to receive 1,500,000,000 calories of solar energy a year?

10. Properly sized roof overhangs can reduce heat gain by 70% on the south side of a house. In calculating the cooling load on your Florida home, an engineer discovered that 40% of your cooling load came from south facing walls and windows.
    a. What percentage of the cooling load would be reduced by proper roof overhangs?
    b. If your cooling costs $1.50 per day and you must cool your house 160 days, how much money can you save by installing awnings and/or roof overhangs?

MIND YOUR ENERGY

Skills Needed:
1. Decimals: Multiplication, division using money
2. Percent: Increase; decrease
3. Ratios and proportion
4. Finding percent

1. Mrs. Grey drives her car an average of 200 miles per week and uses 20 gallons of gasoline. She wants an auto that will travel the same distance but use 20% less fuel. How much fuel will she then use per week?

2. A car uses 100% more gasoline than a motorcycle. If the motorcycle travels 100 miles and uses two gallons of gasoline, how much would the car use to travel the same distance? (Hint: 2 gallons represents 100% for the motorcycle.)

3. After having a motor tune-up on her car, Mrs. Hatch's mpg (miles per gallon) increased from 15 to 18. What was the percent of the increase?

4. Miss Redlin drives her car 20 miles per day to work. In the winter, because of the ice and snow, her mpg decreases from 18 to 14. What is the percent of decrease?

5. During the year Mr. and Mrs. James' light and gas bill increased 15%. If the average cost prior to the increase was $60 per month, how much do they pay after the increase?

6. The cost of a barrel of imported crude oil in 1974 was 300% of the cost of a barrel of imported crude oil in 1973. If a barrel of imported crude oil cost $12.52 in 1974, what was the cost of a barrel of oil in 1973? (Hint: 1973 cost - 100%)
   a. In 1981, a barrel cost 37.59 compared to $1.80 for a barrel in 1970. What percent increase is this?
   b. If this rate of increase continues, project the cost of a barrel of crude oil in 1991.

7. Emission control standards for cars manufactured since 1970 require that carbon monoxide (CO) in exhaust fumes should not exceed 4%. A test of a 1974 car indicated that 150,000 cubic centimeters (cm^3) of an exhaust sample contained 7,000 cubic centimeters of CO.
   a. Determine how many cubic centimeters of CO equals 4%.
   b. Determine how many cubic centimeters the CO must be reduced to meet the 4% requirement.

8. A drop in speed from 70 mph to 50 mph increases the gasoline mileage by 20%. If your car can average 25 mpg at 70 mph, what mileage will your car get if you drive at 50 mph?

9. To conserve energy, Mr. Beamer has decided to install a solar heating system in his home. The cost, excluding taxes and finance charge, is $5000. This installation will reduce his utility bill 60%. Presently his utility bill averages $700 per year.
   a. How much money will be saved yearly after the installation?
   b. If the federal government provides a tax credit of 40%, what is the total tax credit provided by the government on the $5000 system?
   c. How long will it take the savings in the utility bill to pay for Mr. Beamer's reduced cost of $3600? (Assume the average utility bill will remain constant.)

10. "Joule" Energy has just graduated from high school. She has a scholarship to B.T.U. in the fall, but until then she lives with her parents. She just purchased a 1980 Honda Accord (used). She has taken a job at the local gas station for $3.75 per hour. "Joule" works eight hours per day, five days per week. How much does she earn per week? Per month?

    She has a budget plan for her earnings for the month as follows:

Entertainment	$ 90.00
Car Payment	110.00
Snacks	20.00
Gasoline	50.00
Other Needs	8.20

Clothing	30%
Savings	10%

a. How much did "Joule" save each month?

b. How much did she spend on clothing?

c. Which two items listed represent direct use of energy?

d. How much money was spent for energy?

e. What percent of her monthly earnings did she spend for energy?

f. "Joule" spent $50 for gasoline. At $1.28 per gallon how many gallons of gasoline did she purchase?

g. If "Joule's" car can travel 22 miles on one gallon of gasoline, how many miles did she travel on the total amount of gasoline purchased?

11. America's Seven Energy Goals for 1985 are:

1. Reduce the annual growth rate in our energy consumption to less than 2%.
2. Reduce gasoline consumption by 10%.
3. Cut imports of foreign oil to less than 6 million barrels a day, less than half the amount that we will be importing if we do not conserve.
4. Establish a strategic petroleum reserve supply of at least 1 billion barrels, which will meet our needs for about 10 months.
5. Increase our coal production by more than two-thirds, to cover one billion tons a year.
6. Insulate 90% of American homes and all new buildings.
7. Use solar energy in more than 2 1/2 million American homes.

ANSWER QUESTIONS A-H:

A. Last year, energy consumption in the United States was .74 x 10^{18} joules. If consumption had grown by only 2% what would this years consumption have been?

B. This year's consumption was .78 x 10^{18} joules. What was the real growth rate?

C. If the present gasoline consumption is about 100 billion gallons a year, how many gallons of gasoline will be consumed after the 10% reduction?

D. The forecasts in the National Energy Plan show the amount of imported petroleum could be as much as 11 million barrels per day. The President would like to limit the amount of imported oil to less than 6 million barrels per day. If we are able to decrease our imports from 11 million to 6 million barrels per day, what would be the percent of decrease in imported oil?

e. If a billion barrels of oil is enough reserved oil to last the U.S. for 10 months, how much oil do we need per month? Per day?

f. Despite the need to encourage production of domestic forms of energy, the supply of coal recently dropped from 595 million tons to 590 million tons. The President would like to have the industry increase their production to 1 billion tons. What percent of increase from the current level would this require?

g. If there are approximately 70 million American homes, how many must be insulated by 1985 if we are able to insulate 90% by that time?

h. There are 5,000 homes heated by solar energy. The President proposes that 2.5 million homes be heated by solar energy by 1985. What is the increase in percentage of homes heated by solar energy between now and 1985?

THINK
SUN POWER

ANSWER KEY - UNIT II

SOLAR DAILY- Page 2-1
The Newspaper For Sunny Days

Energy Crisis Read or Contrived?

Answer - 10 Years

Solar Sunny's Problem Solver

Answer - 60,000 Ft.^{2}

Sun-Tea

Answer - Depends on the intensity of the sun (4-8 hours)

How many 200-ml servings will you get out of this recipe? 16 servings

Homemaker Helper

Answer - 1st question - 7.6 Years
2nd question - 16 Servings

SUPPLY & DEMAND - Page 2-2 and 2-3

Mr. Sunny, a gasoline station owner, received 200 gallons of gasoline regularly each week. His 20 regular Smalltown customers were used to buying all the gas they needed. Although some weeks some people bought more and some bought less, average use was 10 gallons a week. The total demand for gasoline each week, then was (4) 200 gallons . As you have seen. Mr. Sunny's supply was (4) 200 gallons. Everybody was pretty happy about the whole thing. The supply was equal to the (11) demand.

Mr. Sunny charged $1.10 a gallon for gasoline, a price that was about the same as that charged by the other station in town. Each regular customer spend an average of (5) $11.00 each week. Mr. Sunny received (12) $220.00 for gasoline. When the other station reduced its price per gallon by a penny, four of Mr. Sunny's regular customers deserted him and went across the street. He was still getting a delivery of 200 gallons of week, but now the demand was only (10) 160 gallons. He had (1) 40 gallons left over. This unbought quantity of gasoline is called a (9) surplus. To get rid of the surplus, Mr. Sunny (2) lowered his price. His other regular customers bought up the (9) surplus and took a few more pleasure trips into the city.

Several weeks later, Mr. Sunny and the other station each received only 100 gallons of gasoline. Their customers' demands were still the same, so the pumps soon became empty. "No More Gas!" the sign in front said. Halfway through the week, Mr. Sunny had a (7) shortage of gasoline. By still charging $1.10 a gallon, he didn't make enough to pay the costs of his station.

The next week, he raised the price to $1.15 a gallon. Even at the higher price most of his customers had to buy gas to drive to work and do errands, so he sold all 100 gallons. How much money did he receive? (13) $115.00 What was the average amount each of the 20 regular customers spent? (14) $5.75 What was the average amount of gas each customer used? (6) 5 gallons

ANSWER KEY - UNIT II

SUPPLY & DEMAND - Page 2-2 and 2-3

Some of Mr. Sunny's customers were on a fixed budget and couldn't afford to spend more than $11.50 a week for gas. Some customers got to the station after the pumps were empty and couldn't get all they needed. Some of the other station's customers came over to Mr. Sunny's station. The demand was greater than the (3) supply. Mr. Sunny (8) raised his gasoline prices again.

ENERGY WELL - Page 2-4 and 2-5

1. 1596 million gallons of oil or 1,596,000,000 gallons of oil
2. 17,480,000 barrels of gasoline
   734,160,000 gallons of gasoline
3. 13140 million barrels of oil or 13,140,000,000 million barrels of oil
4. 500,000 barrels
5. $23,000
6. $1,021,000
7. About 16 $\frac{1}{6}$ years
8. 75 trillion cu. ft.
   10.7 trillion cu. ft. per year
9. About 864 trillion cu. ft.
10. 0.0063 BCFD or 63/10000 BCFD
11. (b) 34.87 Million (natural gas)
    12.05 Million (oil)

    (c) 12.82 Million
12. 2.05 trillion cu. ft.
    820 billion cu. ft.
13. 4964 lb. of coal
    1204.5 gal. of oil

    108405 cu. ft. natural gas
    4996.85 Kwh of hydroelectric power

    720 Kwh nuclear power

INSULATE - THEN CELEBRATE - Page 2-6 and 2-7

1. $29.50
2. $9.45
3. $11.70
4. 1692 sq. ft.
5. $473.76
6. 1692
7. $203.04
8. $727.45
9. Same as their cost ($727.45)
10. 15% of $727.45 = $109.12
11. $225.00

ANSWER KEY - UNIT II

WATT'S HAPPENING? - Page 2-8, 2-9, and 2-10

1. (a) 300 watt hr.
   (b) 9000 watt hr.
2. (a) 1125 watt hr.
   (b) 7875 watt hr.
   (c) 33750 watt hr.
3. (a) 116.66 watt hr.
   (b) 816.6 watt hr.
   (c) 3500 watt hr.
4. (a) 437.50 watt hr.
   (b) 3062.5 watt hr.
   (c) 13,125 watt hr.
5. (a)
   (b) 22,000 watt hr.
6. 8,950 watt hr.
7. (a) 375 watt hr.
   (b) 136,875 watt hr.
8. (a) 27000 watt hr.
   (b) 1. 18,000 watt hr.
       2. 90,000 watt hr.
   (c) 1. 20,250 watt hr.
       2. 12,1500 watt hr.
       3. 607500 watt hr.
       4. 7,391,250 watt hr.

Change the following watt hours to kilowatt hours.

1. 21.6
2. 7.7
3. 3.4
4. 15
5. .004
6. 2
7. .042
8. .29
9. .016
10. .0017

WORK OUT YOUR ENERGY - Page 2-11, 2-12, 2-13, 2-14, and 2-15

1.

Mathematics:	0.9 kg	W = .9 x .7 =	63 kg/m
Science:	1.1 kg	1.1 x .7 =	.77 kg/m
Social Studies:	1.3 kg	1.2 x .7 =	.91 kg/m
English:	2.0 kg	2 x .7 =	1.4 kg/m

.7 m

WORK OUT YOUR ENERGY - PAGE 2-11, 2-12, 2-13, 2-14, and 2-15

2. a. 15 rungs 15 x 200 = 3000 ft.-lb.
   b. 45 rungs 45 x 200 = 9000 ft.-lb.
   c. 150 rungs 150 x 200 = 30,000 ft.-lb.

3. F = 20,000 ft.-lb.

4. 60 = ft.-lb.

5. 45.5 x 1.2 = 54.6 Kg/m

6. a. 66 ft/pds. per sec.
   b. 99 ft/pds. per sec.
   c. 198 ft/pds. per sec.

7. a. 10.2 Kg-m/per sec.
   b. 13.6 Kg-m/per sec.
   c. 20.4 Kg-m/per sec.
   d. 40.8 Kg-m/per sec.

8. a. 2 times as much
   b. 3 times as much
   c. 4 times as much

9. a. 7 horsepower
   b. 15 horsepower
   c. 50 horsepower

10. a. 1375 ft-lbs/sec.
    b. 30250 ft-lbs/sec.
    c. 71500 ft-lbs/sec.
    d. 123750 ft-lbs/sec.

ENERGY I$ MONEY - Page 2-16, 2-17

1. a. $34.99 water heater
   $10.00 range
   $ 8.32 dryer
   $14.98 refrigerator

   b. $0.30 water heater
   $0.09 range
   $0.072 dryer
   $0.13 refrigerator

2. Graph

3. Electricity - $8.25

4. $3.277.5 cu. ft.

5. 4,000,000 or 4 million cu. ft.

6. $2,000,000

7. $35.70

8. $40.00 monthly
   $480.00 yearly

ENER-MATH, page 2-18, 2-19, and 2-20

1. a. 500 watt hours
   b. 1/2 kwh
   c. .035¢ ea. day
      $.25 ea. seven days
2. $500
3. 26 mpg
4. a. 11.88%
   b. 8.417 years
5. $51.75
6. 1.706 tons
7. 2082 Kw
8. 1512 million gal. per day
9. a. 6.25 bbl.
   b. 6000 cu. ft.
   c. 3750 lbs.
10. 23.3 million homes
11. 17.1%
12. $13.44
13. 20.46 trillion cu. ft.
14. 0.375 million barrels
15. $180 million
16. $468
17. One percent or 1%

GASOLINE: A NECESSARY EVIL? - Page 2-21, 2-22, 2-23, 2-24, and 2-25

1. 18¢ or $.18

2. $\frac{18¢}{130¢}$ or $\frac{\$.18}{\$1.30}$

3. 31.5 mpg

4. 12.8%

5. 258,750 barrels

6. $\frac{223}{1200}$ spent on car. $\frac{17}{240}$ for energy fuel

7. $26.00

8. a. 30.8 gal. at 50 mph
   34.3 gal. at 60 mph

   b. $40.04 at 50 mph
   $44.57 at 60 mph

   c. $4.53

9. a. 1. 5 hr.
   2. 3.6 hrs.
   3. 2.9 hrs.

   b. 1. 10.5 gal.
   2. 11.8 gal.
   3. 22.2 gal.

   c. 1. $13.65
   2. $15.34
   3. $28.86

10. a. $272.70 at 55 mph
    $230.70 at 65 mph

    b. $42.00

    c. $225.82 at 65 mph
    $200.06 at 55 mph

    d. $25.76

    e. Saved $25.76 in full, but paid $42.00 more in wages
    Overall the company lost $16.24

    f. Saved $18.40 gal. of fuel

11. a. 27 mpg

    b. 1.13 gal. - to nearest tenth
    2.14 gal. - to nearest tenth

    c. 1. $16.90
    2. $18.20

    d. $1.30

12. a. 424.2 gal.

    b. 30.4 mpg

    c. 460.5 gal.

    d. $47.19

13. a. 132 gal.

    b. 98.1 gal.

14. $44.07

CALCULATIONS WITH BIOMASS, Page 2-26 and 2-27

1. 150 million BTU
2. 220900 sq. mi.
3. 7200 gal.
4. 150%
5. 175%
6. 122%
7. $3.71 billion
8. $6,000 million or $6,000,000,000
   ($6 billion)
9. a. 30,000,000 bushels
   b. 78,000,000 gal.
   c.
   d. Price would sky rocket because of the scarcity

ENERGY AT HOME: CONSERVATION & SOLAR ENERGY - Page 2-28 and 2-29

1. a. $23,200,000
   b. Twenty-three million, two hundred thousand dollars
2. a. $191.88
   b. $70.00
   c. 10 yrs. 0 months
   d. $105
   e. 8 yrs. 6 months
3. 100%
4. a. 12,000,000 barrels (twelve million)
   b. 504 million gal.
   c. 70560 million BTUs
5. $310.25
6. 7.6 years
7. One and one-half million BTUs
8. 16.9%
9. 1200 $ft.^2$
10. a. 70%
    b. $72.00

MIND YOUR ENERGY - Page 2-30, 2-31, 2-32, and 2-33

1. 16 gal.

2. 4 gal.

3. 20%

4. 22.2%

5. $69.00

6. $37.56

   a. 1988.3%

   b. $74.74 per barrel

7. a. 6000 cm^3

   b. 1000 cm^3

8. 30 mpg.

9. a. 420

   b. $200

   c. 8 1/2 yrs.

10. $150 per week
    $600 per month

    a. $60.00
    b. $180
    c. car and gasoline
    d. $160.00
    e. $26.6%
    f. 62 1/2 gal.
    g. 1375 mi.

11. a. $.7548 \times 10^{18}$

    b. 5.41%

    c. 90 billion gal/yr.

    d. 45.5%

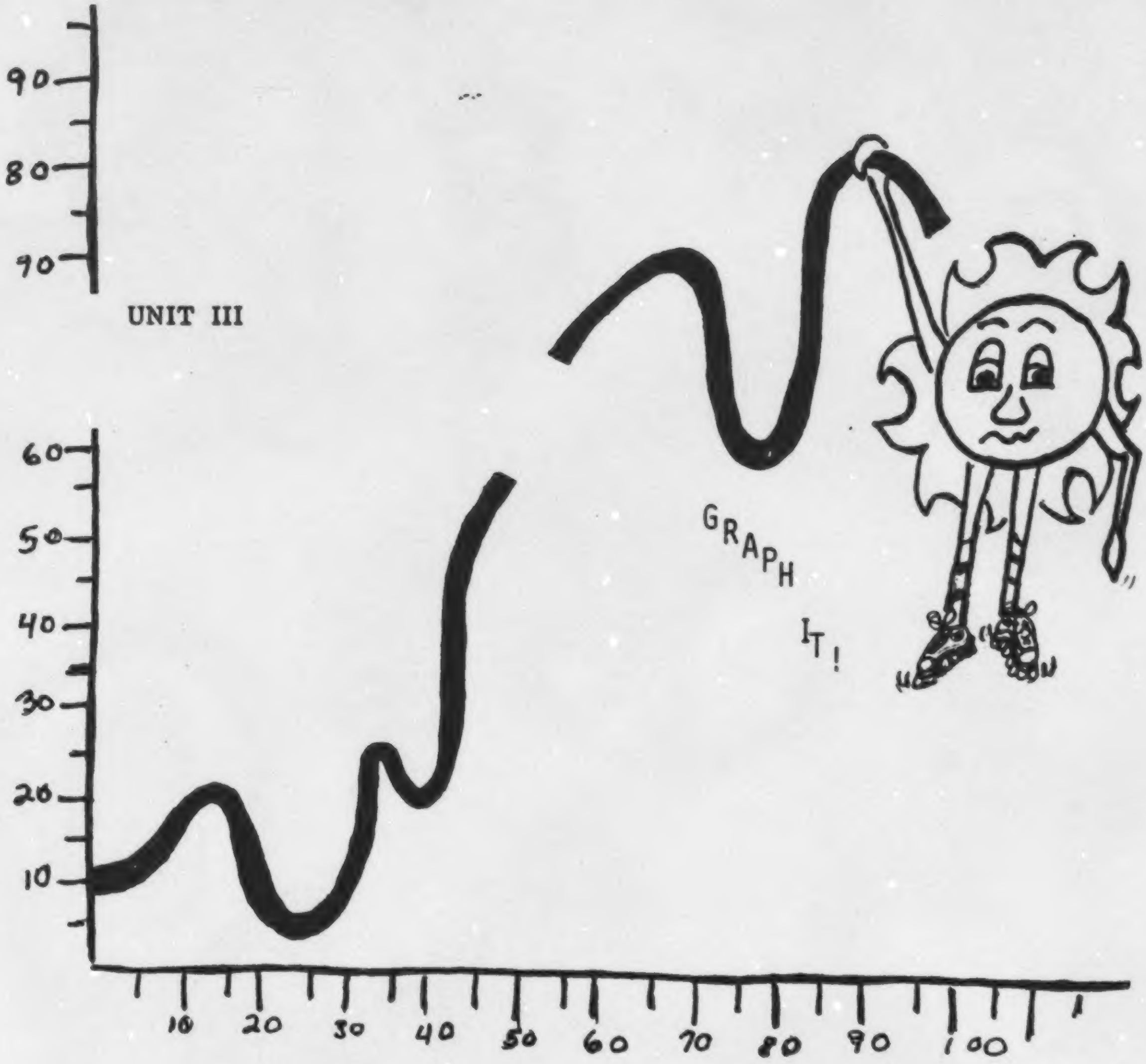
    e. 100 million barrels per month
       3.3 million barrels per day

    f. 69.5%

    g. 63 million homes

    h. 49,900%

UNIT III


90
80
70
60
50
40
30
20
10
10
20
30
40
50
60
70
80
90
100
GRAPH IT!

These graphing exercises help to develop the student's skills in interpreting information on a bar graph, line graph, and circle graph. It also helps them apply these skills by having them use data in a table and constructing a set of graphs. In addition they should learn some important quantitative facts about energy by working with graphs which show information quickly.

UNIT III GRAPH IT!

Reading Graphs & Tables 3-1

Graphs Tell The Energy Story 3-2, 3-3

Efficiency Of Energy Sources 3-4

Changing Fuel Sources 3-5

Be Aware Of Energy Users 3-6

Sun Energy 3-7

Collectors 3-8, 3-9

One Average Summer Month Home Energy Use 3-10

Seven Energy Goals For 1985 3-11

Effect Of Speed On Fuel Consumption Rates 3-12

Florida Gasoline Consumption 3-13

Florida Energy Profiles - Total Energy Consumption By Sector, Florida And The United States 3-14

Rising Oil Prices 3-15

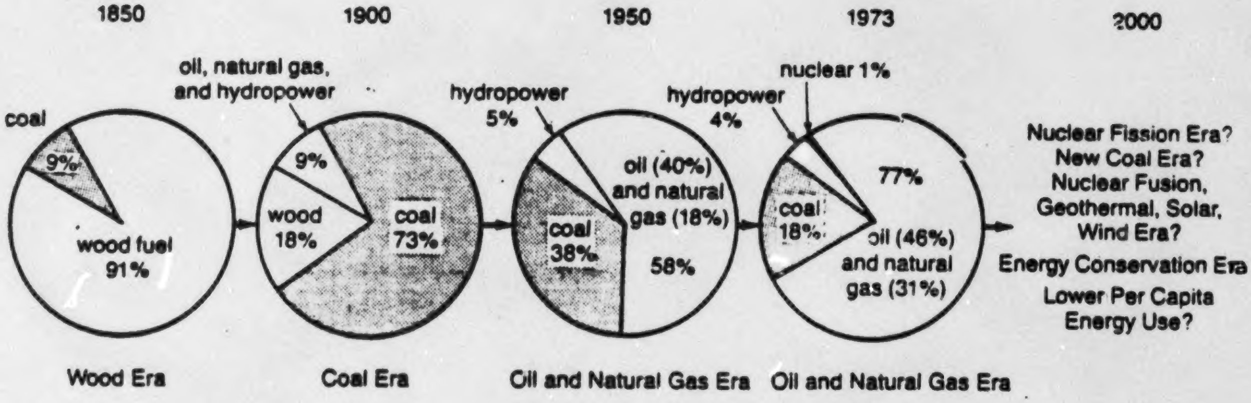
READING GRAPHS AND TABLES

The field of energy information is enormous. A student of the subject can become overloaded with facts and never arrive at the answers he or she was seeking. To overcome that problem students must develop two skills: asking the right questions and understanding how to read tables and charts.

Asking the right questions means that an investigator has thought about the subject and decided what he/she would like to find out. By putting these decisions into question form, a student can quickly look over information and only concentrate on facts that relate to the questions.

Reading charts and graphs is useful to an investigator because they are efficient ways to present information concerning matters of quantity. Look at the graphs below. Imagine how many sentences it would require to communicate the same information in complete sentences.

CHANGING PATTERNS IN THE USE OF ENERGY RESOURCES
IN THE UNITED STATES



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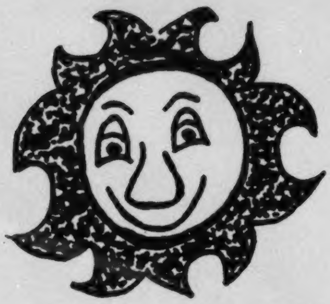
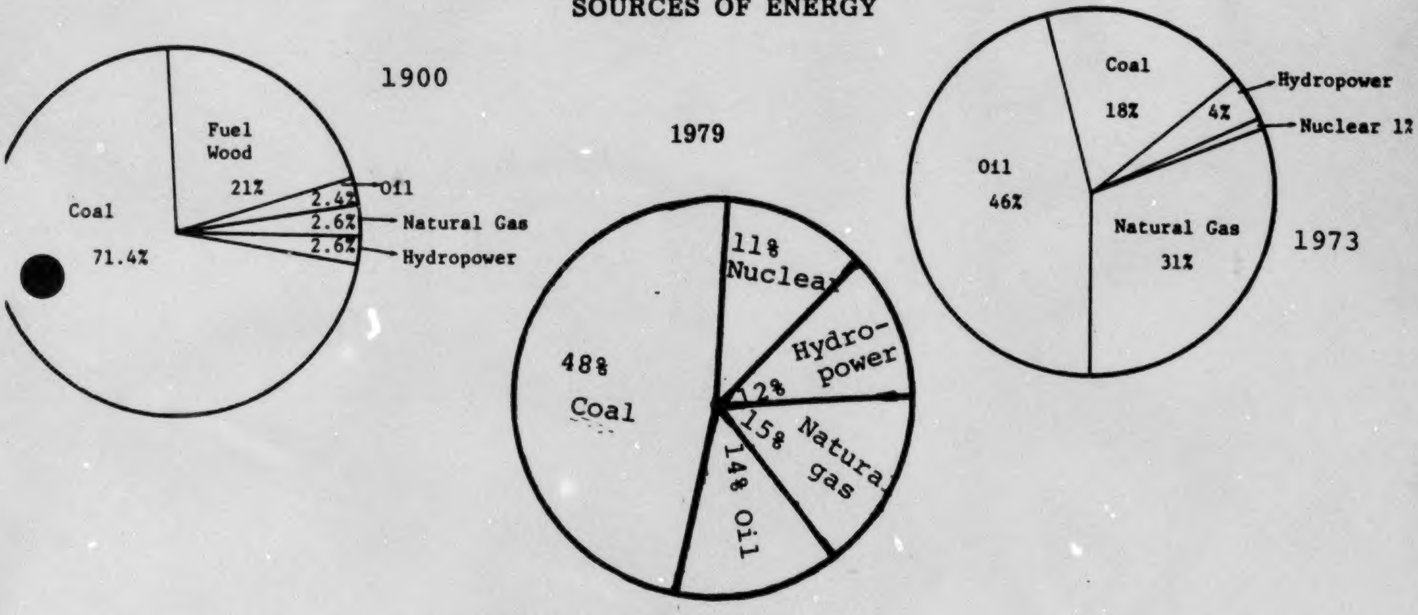


GRAPHS TELL THE ENERGY STORY

SOLAR ENERGY -- Most energy used by man is from the sun. Whether it be oil, gas, coal, water, or wind it started with the sun. Heat from the sun causes air currents to create wind and waves; decomposition, heat and pressure of plant and animal life produces oil, gas, and coal.

Study these circle graphs below and answer the questions which follow.

SOURCES OF ENERGY



1. In 1900 which source of fuel was used most?
2. What source of fuel was used in 1900 but not in 1973? or 1979?
3. What source of fuel was used in 1973 and 1979 but not in 1900?
4. How much more (%) natural gas used in 1973 than in 1900?
5. In which year was the least percent of fossil fuel used?
6. In 1979 which source of fuel was used most?
7. How much more (%) coal was used in 1979 than in 1973?
8. How much more (%) hydropower was used in 1979 than 1973?

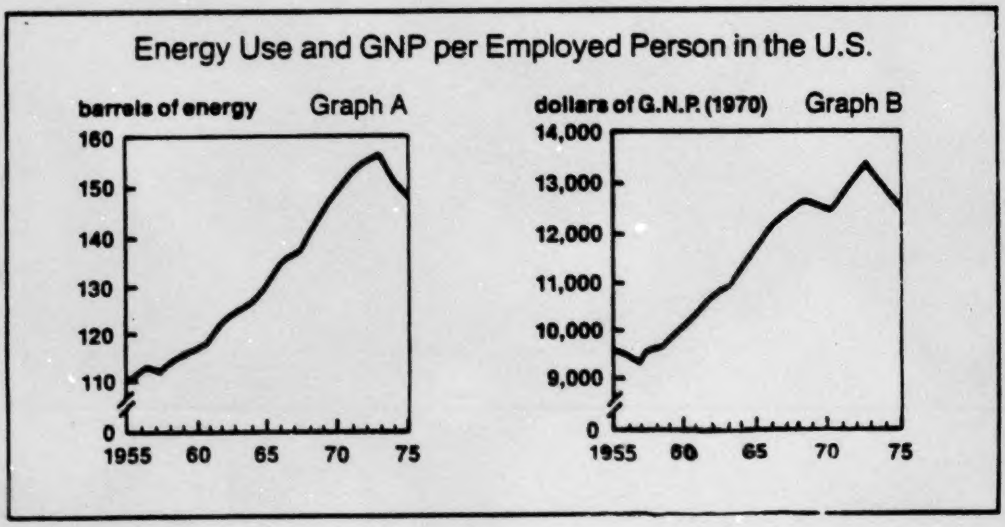
Hint To Students:

Graphs and charts usually appear to be quite complex, abstract and overwhelming. Any complex graph, map or any research problem may cause you frustration and to ask, "Where do I begin? How am I ever going to do this?" The trick is not to look at the whole graph. Concentrate on one thing at a time and for the moment ignore all other parts of the graph.

Study the graph one step at a time and you will enjoy greater success and develop a skill in handling graphical information.

1. Begin with the title. Read this carefully so you know what information the graph contains. Often people try to make the graph show something it doesn't address.
2. Identify the labels (categories) on the horizontal and vertical axis. These will tell you what is being compared and how the comparisons are made.
3. Extract the facts from the graphs.
4. Then draw inferences from the graph and evaluate the data.

Now practice these steps on the following two graphs in the figure below.

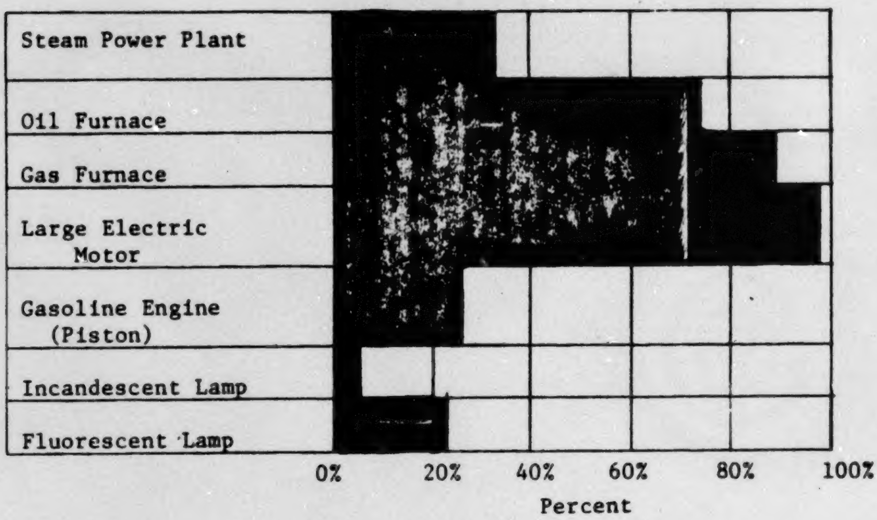


Energy Use and GNP per Employed Person in the U.S.

EFFICIENCY OF ENERGY SOURCES

The "efficiency" of an energy source is measured by a comparison of the output (in energy, time, money, etc.) with the input of the same quantity. The following bar graph shows:

PERCENTAGE OF ENERGY USED WHICH IS CONVERTED TO USEFUL WORK



1. What percent of energy is converted to useful work for each plant, furnace, etc.?
2. Which of the above energy sources is most efficient?
3. Least efficient?
4. What happens to the energy not converted to useful output?
5. Make some suggestions on improving the efficiency of each item in the chart?
6. Is the efficiency of the large electric motor a correct picture?

CHANGING FUEL SOURCES

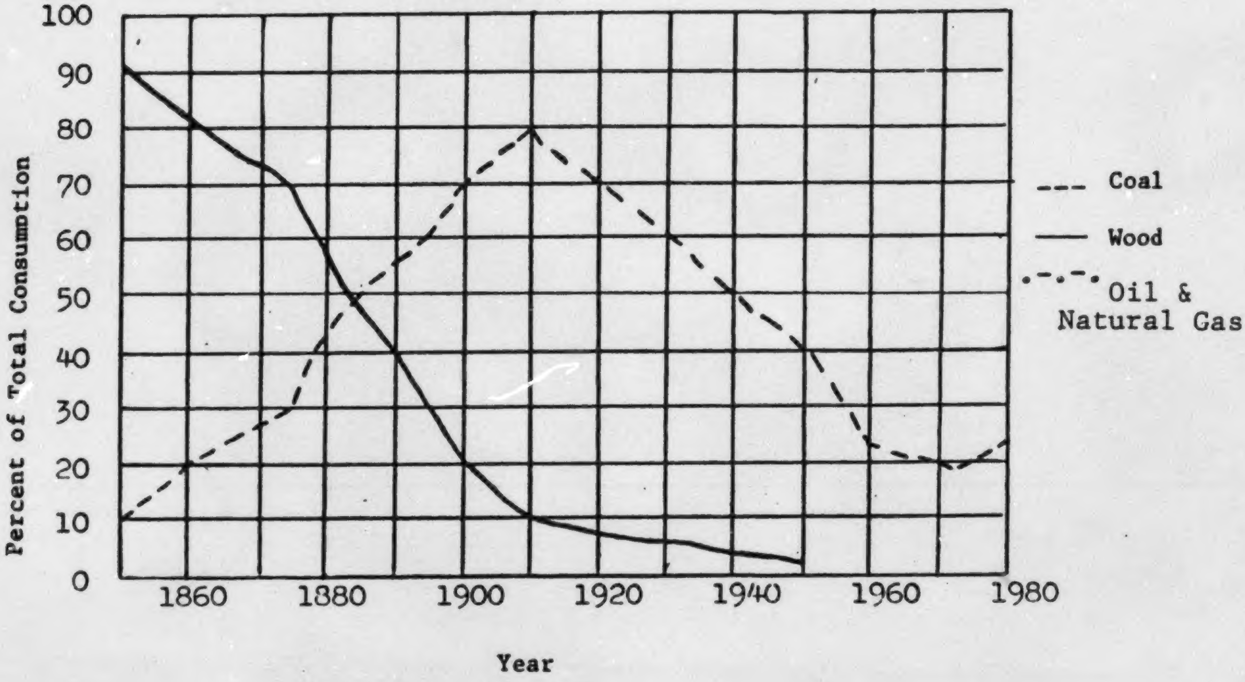
The graph below shows the changes of two energy sources in the United States. Add the third piece of data to the graph and answer the following questions.

1. Complete the graph below given the following information pertaining to petroleum and natural gas.

Year	1890	1900	1910	1920	1930	1940	1950	1960	1970	1975	1980
% of Consumption	3	6	10	20	30	42	52	70	75	79	70

2. In what year did wood make up over 90% of the energy in the U.S.?
3. In what year was energy supplied equally by wood, and oil, and natural gas?
4. In what year did coal reach its peak of importance as an energy source?
5. Based on this graph, what period of time would you label "The Age of Coal"? Why?

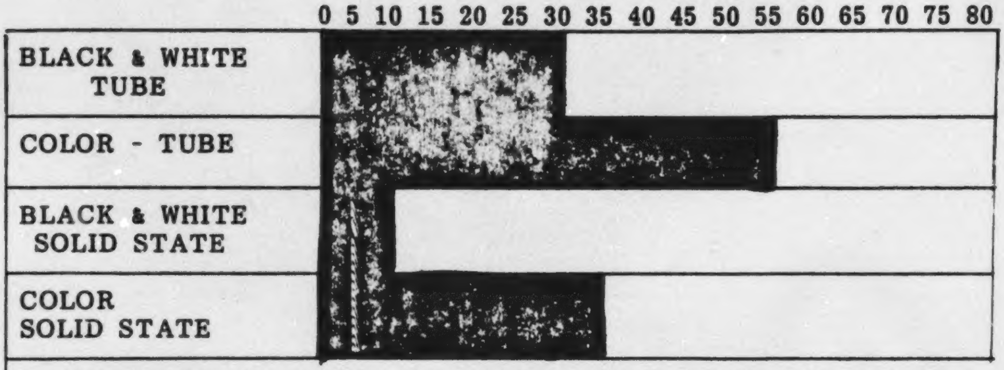
CHANGING FUEL SOURCES IN THE UNITED STATES



BE AWARE OF ENERGY USERS

DIRECTIONS: Use the bar graph below to fill in the blanks.

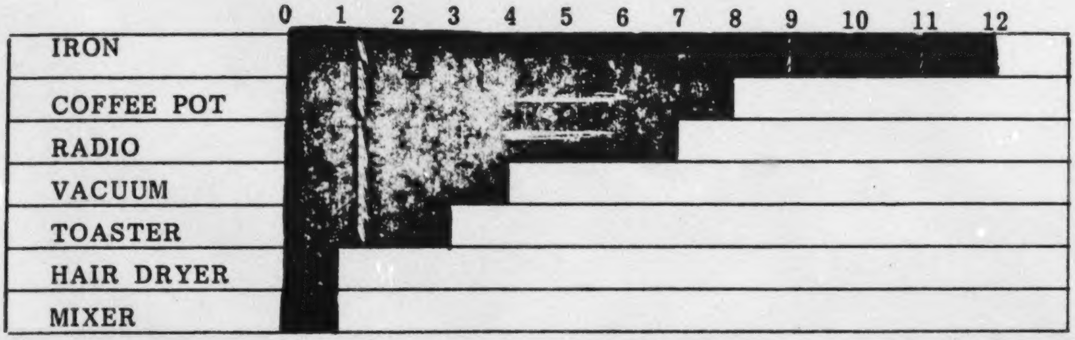
TELEVISION - ENERGY USAGE*



* NUMBER OF KWH USED BY A FAMILY OF FOUR IN ONE MONTH

1. A black and white solid state television uses ______kwh every month.
2. A solid state color television uses ________kwh more than a solid state black and white television.
3. The black and white tube television uses ______kwh more than a black and white solid state television.
4. The color (tube) television uses ________kwh of electricity.
5. How many kilowatt hours are used to run all four televisions?__________

NUMBER OF KILOWATT HOURS USED BY A FAMILY OF FOUR IN ONE MONTH

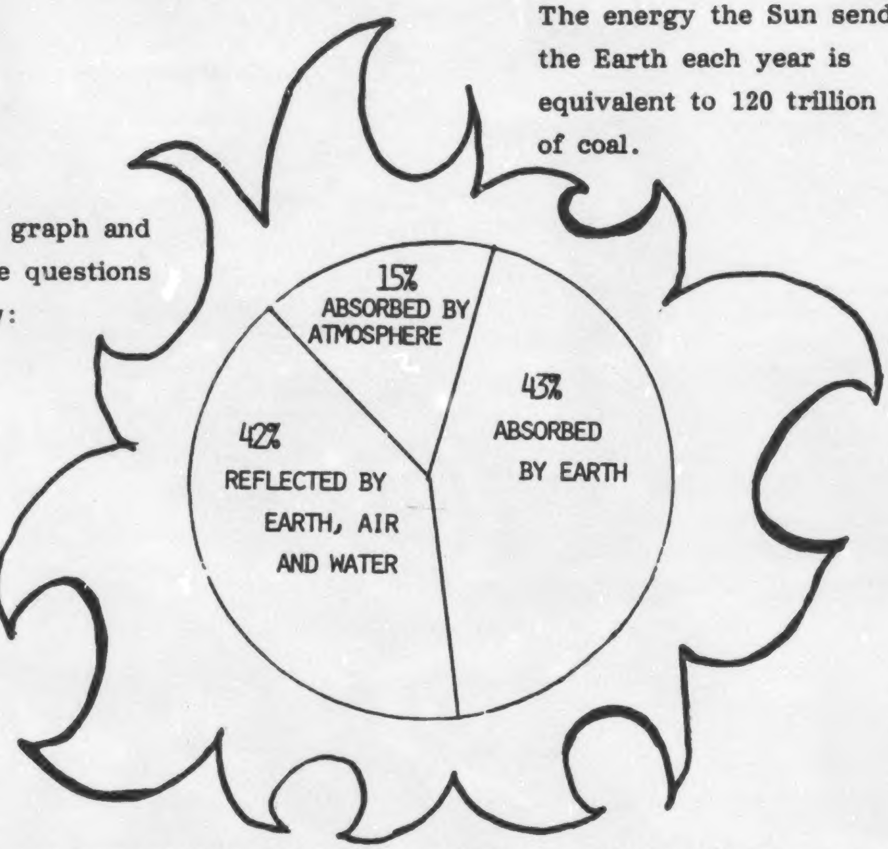


1. How many kilowatt hours are used playing the radio?________________
2. How many kilowatt hours are used to run the vacuum?________________
3. How many kilowatt hours do the iron and coffee pot use altogether?__________
4. How many more kilowatt hours does the coffee pot use than a toaster?_______
5. What is the total amount of kilowatt hours consumed by all these appliances?___________

SUN ENERGY

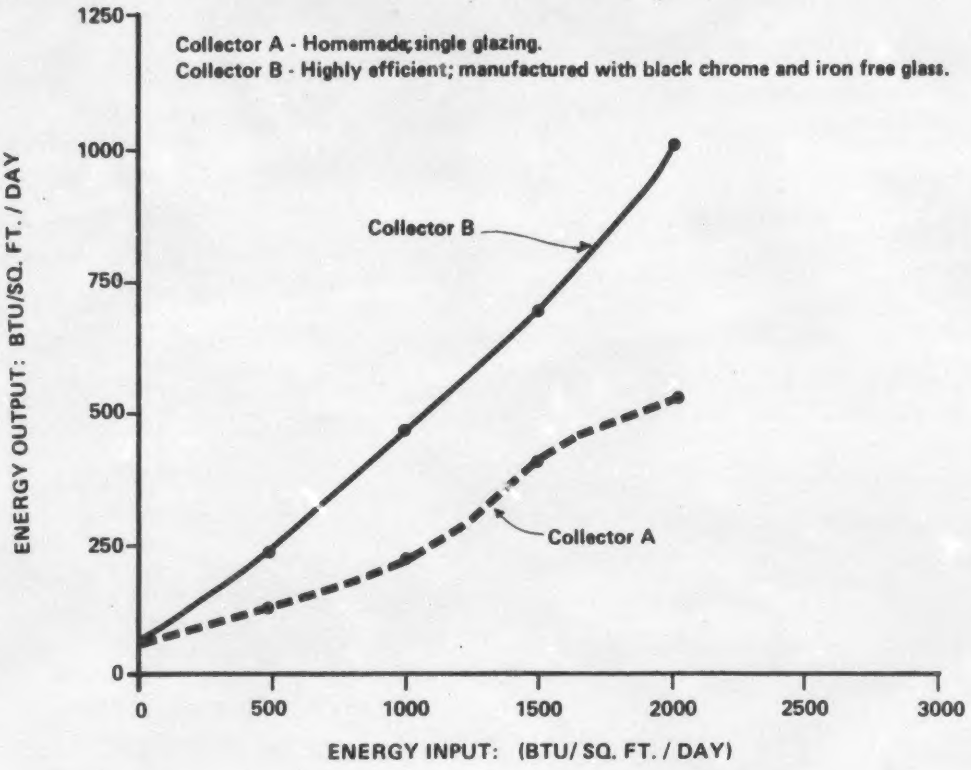
The energy the Sun sends the Earth each year is equivalent to 120 trillion tons of coal.

Study the graph and answer the questions that follow:



1. As the energy is transmitted how much is absorbed by the atmosphere?
2. How much solar energy is reflected by earth, air, and water?
3. How much solar energy is absorbed by the earth?
4. Green plants convert about 1% of the available solar energy into biomass material. Each year plants fix about 220 billion tons of carbon with an energy content of 3,000 quads. In terms of percent, how much more biomass is available.
5. Photovoltaic cells convert sunlight into electricity. Some scientists want to set up space stations with cells while others argue that land-based applications are better. Describe the relative amounts of solar energy available in space and on earth.

COLLECTORS



Collector A was built by Kacie and her mother. They compared the efficiency of their collector with one that was tested at the Florida Solar Energy Center and made a graph of the results. Using the information provided, answer the following questions:

1. Complete the following table.

SOLAR ENERGY IN	COLLECTOR A		COLLECTOR B	
	BTU'S OUT	RATIO	BTU'S OUT	RATIO
500	100	.20		
1000			450	.45
1500				
2000				

2. Make a bar graph comparing the ratio's of the two collectors. Which one is more efficient?

3. The homemade collector, A, costs about $300.00 to build; Collector B cost $850.00. Compare the collectors in terms of cost per delivered Btu. Assume a 1500 Btu/sq. ft./day solar day.

Collector A ________ $/Btu
Collector B ________ $/Btu

4. Which collector is the better bargain. Explain your choice using your previous calculations.

ONE AVERAGE SUMMER MONTH HOME ENERGY USE

Listed below are the percents of total energy used by the most common appliances on the home/year.

Electric Range	11%
Television	5%
Clothes Dryer	4%
Water Heater	22%
Air Conditioner	35%
Refrigerator	18%
Dishwasher	4%
Miscellaneous (Small Appliances)	1%

a. In the space below construct a bar graph of the information given above.

b. Which appliance(s) uses the most energy?

c. Which appliance(s) uses the least?

d. Can you think of ways to conserve the energy used by these appliances?

SEVEN ENERGY GOALS FOR 1985

One of the former President Carter's Seven Energy Goals for 1985, as stated in his speech to Congress on April 12, 1977, is as follows:

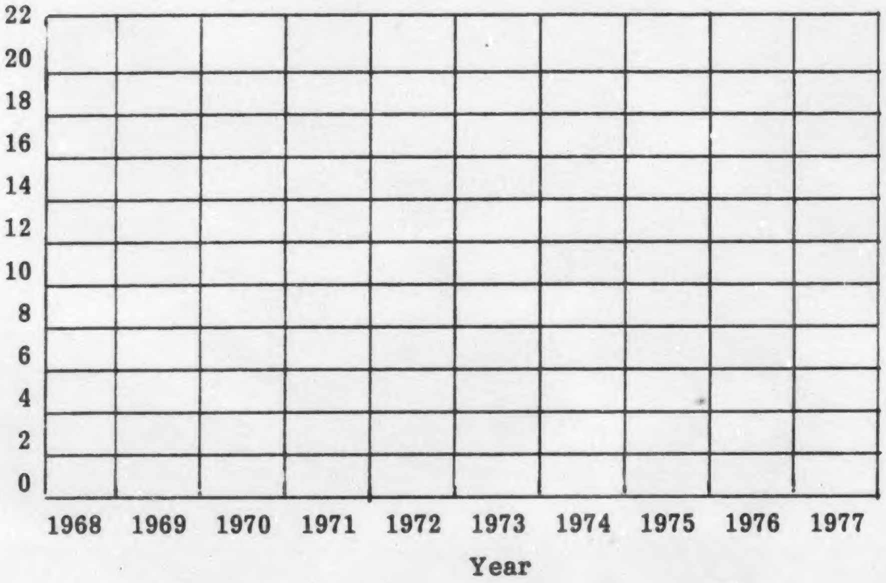
> Increase our coal production by more than two-thirds to over 1 billion tons a year. Despite the need to encourage production of domestic forms of energy, the supply of coal dropped from 595 million tons in 1972 to 590 million tons in 1973. Former President Carter recommended the industry increase their production to 1 billion tons. What percent of increase from the 1973 level would this require?

Make a bar graph (in the space below) to show the average cost of coal paid by the TVA (cost in dollars).

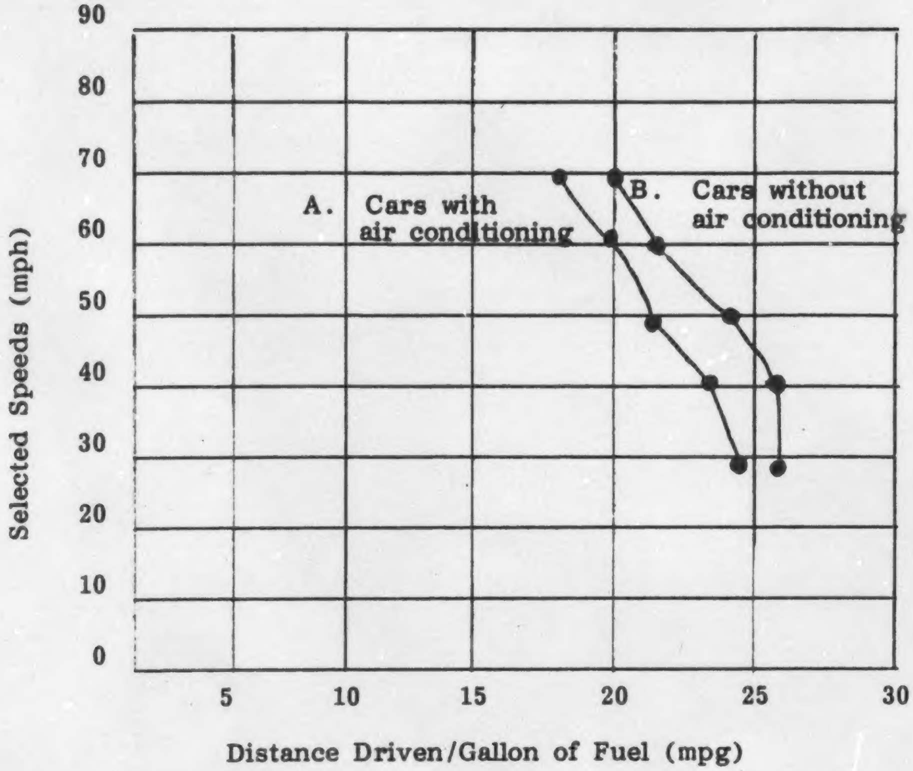
Average Cost of Coal Burned by TVA

Year	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Cost Per Ton	4	4	4.50	6	7	7.50	8	12.50	18	21.50

AVERAGE COST OF COAL BURNED BY TVA

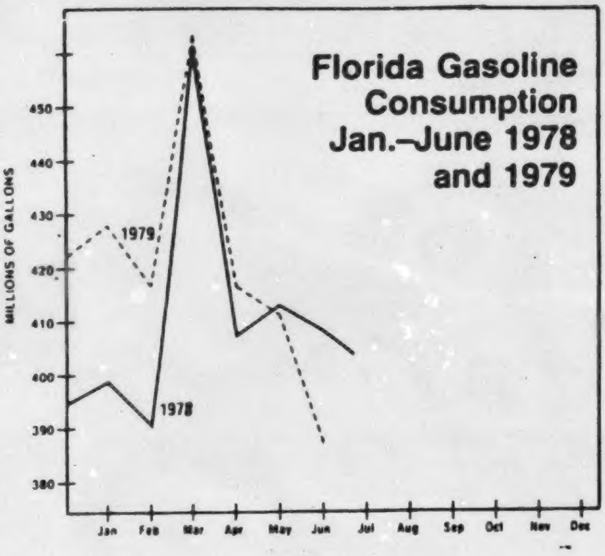


EFFECT OF SPEED ON FUEL CONSUMPTION RATES

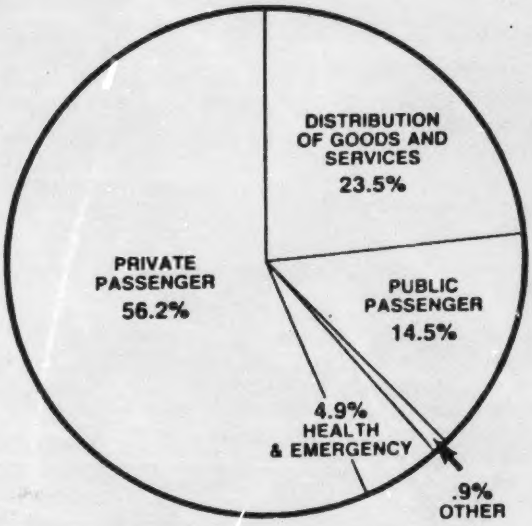


1. At what speeds will Cars A and B travel farther on one gallon of fuel?
2. What will be the rate of fuel consumption when the cars travel at their minimum fuel consumption rate according to the graph? (Hint: 1 gal. per _____ mi. at 30 mi./hr.)
3. At 55 mph what is the fuel consumption rate for each car?

FLORIDA GASOLINE CONSUMPTION



Energy Consumed in Transportation in Florida, 1976



Using the line graph above, answer these questions.

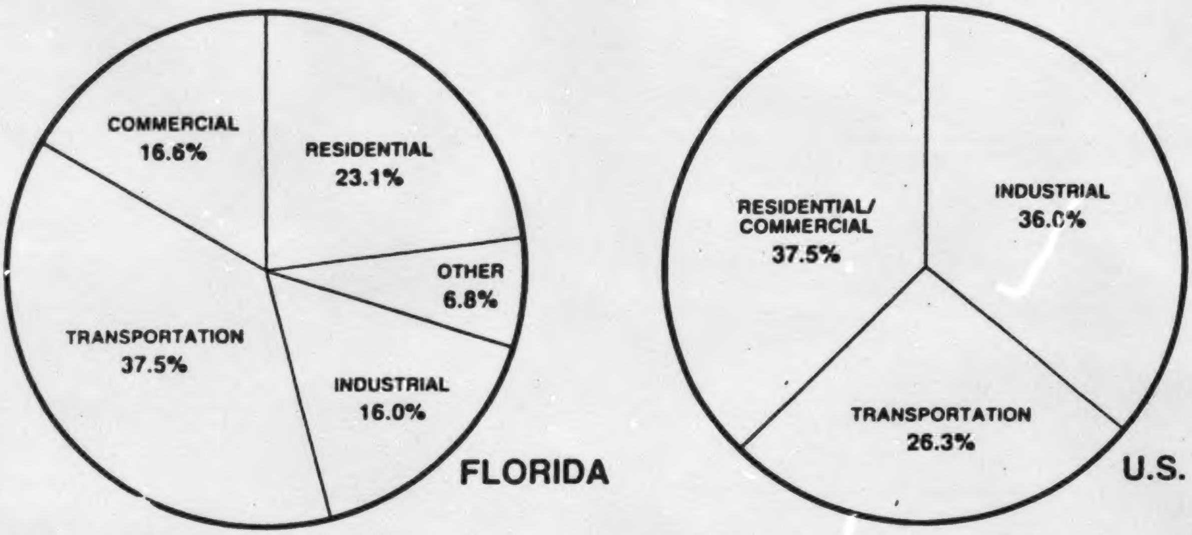
1. During what months was the 1978 gasoline consumption in Florida greater than in 1979? ______________________________
2. Supply constraints became evident by March 1979, what happened in June of 1979? ______________________________
3. What happened in June of 1979? ______________________

Using the circle graph above, answer these questions.

4. More than half of all energy consumed for transportation in Florida fuels ____.
5. Slightly less than one-fourth of transportation energy consumption is devoted to ____.
6. 4.9 percent of energy consumption was used for __________________.

FLORIDA ENERGY PROFILES

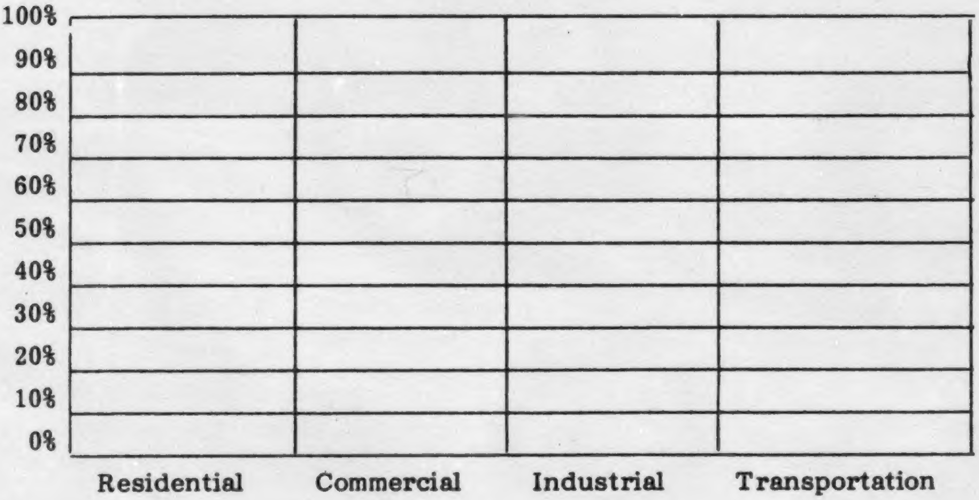
TOTAL ENERGY CONSUMPTION BY SECTOR, FLORIDA AND THE UNITED STATES



Study the circle graphs and answer the questions that follow:

1. What is the largest energy consuming sector of the Florida economy?
2. What is the largest energy consuming sector of the U.S. economy?
3. What is the total residential and commercial consumption in Florida? Is this a greater or smaller percentage than the U.S.?
4. What is the ratio of Florida industrial consumption to U.S. industrial consumption?
5. Using the circle graph on Florida Total Energy Consumption, make a bar graph on this sheet. Answer the questions below.

BAR GRAPH



RISING OIL PRICES

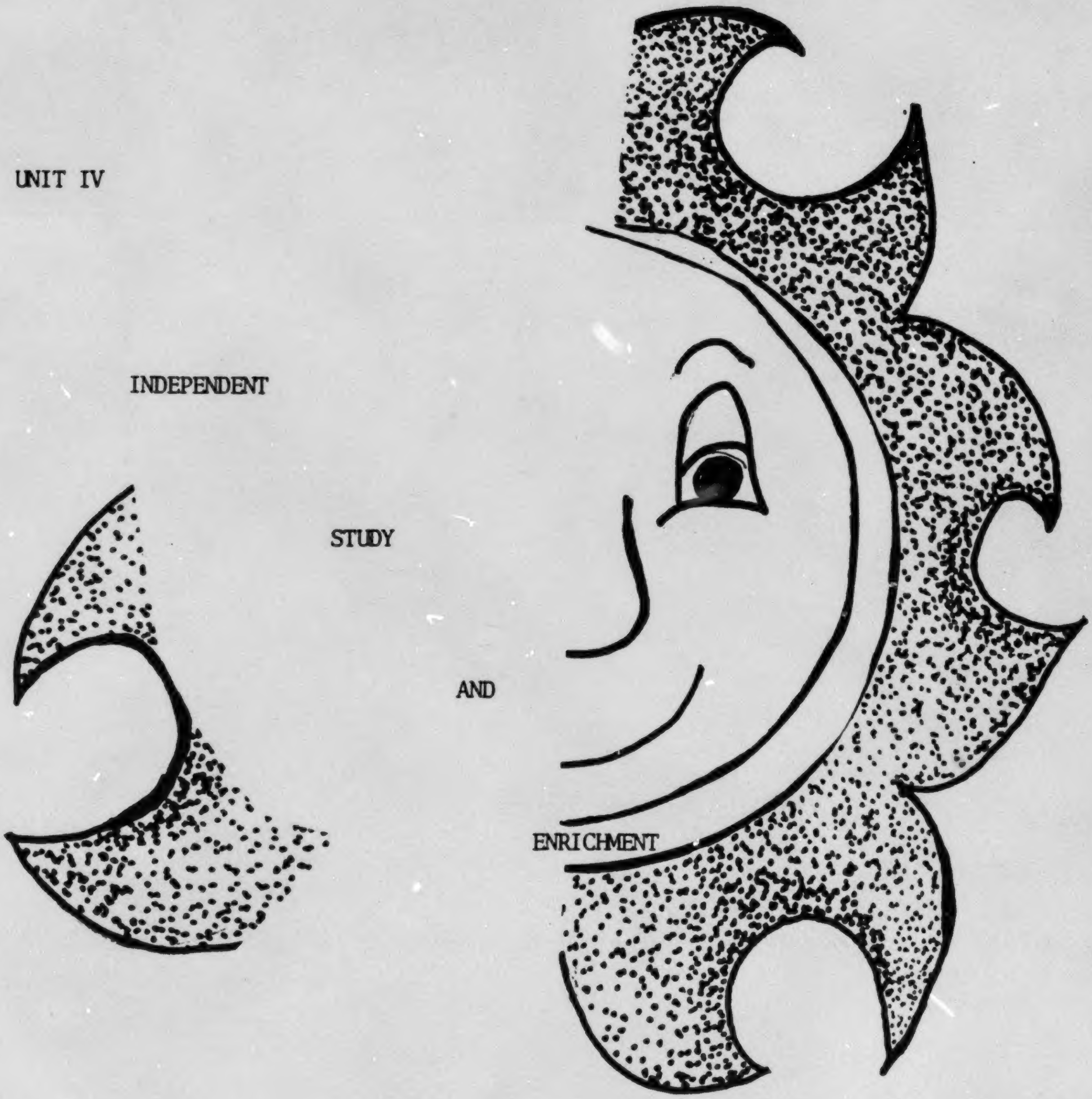
An American energy crisis occured in 1973-1974. The Organization of Petroleum Exporting Countries (OPEC) forced oil prices upward to gain control of the market. They then placed an oil embargo on the oil imported by the United States. The result was a tremendous increase in oil prices. In 1971 the price began to rise again.

YEAR	COST
1970	$ 1.80
1971	2.18
1972	2.48
1973	5.18
1974	11.25
1975	12.38
1976	13.48
1977	14.53
1978	14.57
1979	21.67
1980	33.89
1981	37.59

Make a line graph (in the space line below) to show the trend in oil prices from 1970 to 1981.

UNIT IV

INDEPENDENT STUDY AND ENRICHMENT



Teachers are encouraged to use these activities as individual projects for students.

UNIT IV INDEPENDENT STUDY AND ENRICHMENT

SHOWERS OR BATHS? 4-1

EFFECT OF CONSERVATION ON ENERGY CONSUMPTION 4-2

LIGHT BULB HEAT 4-3

HOW MUCH ENERGY DO YOU USE? 4-4

THE ORTEP-EATING SNARF 4-5, 4-6, 4-7

PRINCIPLE OF DOUBLING OVER TIME 4-8, 4-9, 4-10

ELECTRIC METER-READER 4-11

ENERGY AWARENESS 4-12, 4-13, 4-14

ENERGY RESEARCH 4-15, 4-16

SHOWERS OR BATHS?

Materials: meter stick

Procedures:

1. The next time you take a bath, bring your meter stick and a data recording sheet. Before you step in, use your meter stick to measure the depth of the water in the tub.

2. Calculate the volume of the water by measuring the other dimensions of the tub.

3. Empirically find out the relationship between a gallon of water and a cubic meter.

4. The following bath should be a shower! Only this time put the stopper in the tub. When you are finished, measure the depth of the water.

5. What are the answers to the following?

   a. volume of water for bath________________m^3

   b. volume of water for shower______________m^3

   c. gallons of water for bath_______________

   d. gallons of water for shower_____________

FACT: It takes about one cubic feet of gas, or an oz. of oil, or ¼ kwh of electricity to heat a gallon of water.

6. How many cubic feet of gas could you save by taking showers instead of baths for one year? Repeat for kwh of electricity.

EFFECT OF CONSERVATION ON ENERGY CONSUMPTION

Materials: Data sheets, log of activities, graph paper.

Procedures:

1. Each day for seven days and at a predetermined time, e.g., 4 p.m., record the kwh reading on your electric meter at home. Record your results.

DATA SHEET

Date	Reading	kwh Used	Total kwh Used
....	....	....	....

2. Graph the number of kwh used each day as a function of the day of the week.

   Is there any observable difference in the use of power on the different days? Make this and all other observations an entry in your log.

3. Ask the members of your family to help by actively conserving* energy for at least one week. Record the same data as before on a new data sheet. Plot the second week's data on the same graph as the first week's data.

4. Calculate the number of kwh saved:

   a. for one week.
   b. for one year.

5. At a cost of 7.5 per kwh, what is the savings for:

   a. one week.
   b. one year.

6. Use table one to determine how many cubic feet of natural gas you would save in one year if the conservation measures wer maintained.

7. Answer question six for tons of coal.

8. If 10,000 families in your community conserved electricty at the same rate as you have calculated, how many barrels of oil could be conserved in one year?

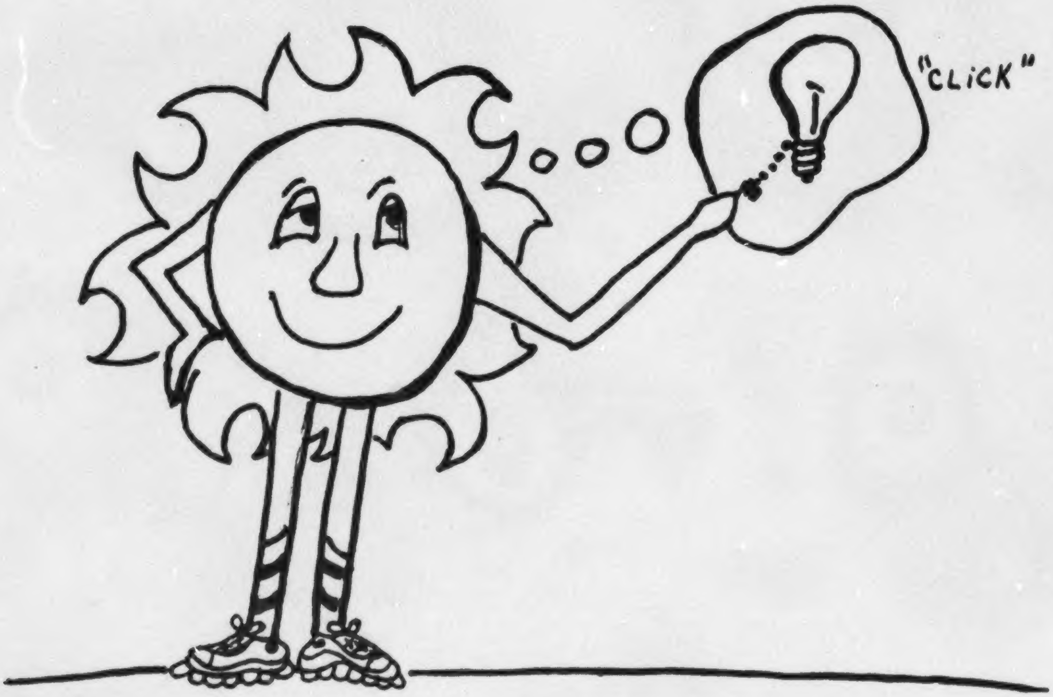
*Review the suggestions for saving energy with your family.

LIGHT BULB HEAT

Materials: Data sheets, tables one and two.

Procedures:

1. Count the light bulbs in your home and list their wattages.
2. Over a period of two days, estimate the number of hours per day each bulb is used by noting the time each bulb is turned off or on.
3. Calculate the average kwh per month of each bulb.
4. Calculate the kilocalories used by the bulbs in your house:
   a. for one month.
   b. for one year.
5. If all the wattage ratings in the bulbs were reduced by 12%, (i.e., the bulbs were switched out), what would the kilocalories be for one year?
6. How much natural gas is required to run the light bulbs in your house for one year?



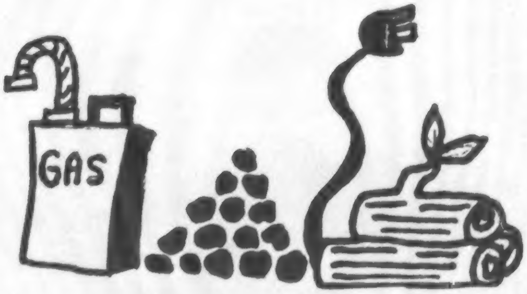
HOW MUCH ENERGY DO YOU USE?

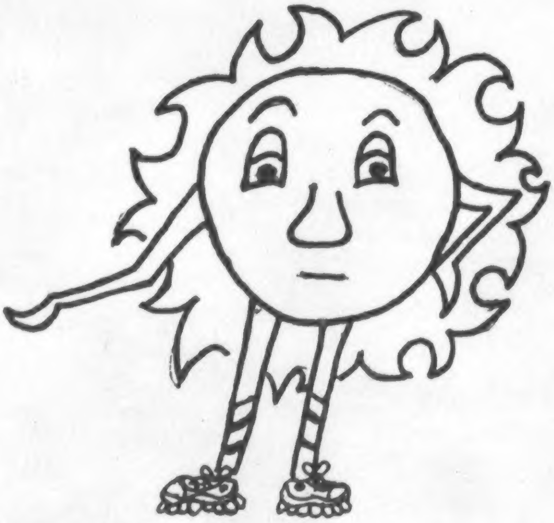
Materials: Data sheet, conversion tables

Procedures: For one month, record every type of energy you convert to your own use.

1. How much electricity do you use? Number of kwh for your home divided by the number of members in your family.
2. Number of gallons of gasoline consumed for your car. If you take a bus, consult your local transportation agency for an estimate.
3. Number of cubic feet of gas consumed. Use meter figure divided by the number of members of your family.
4. Amount of coal or wood consumed if applicable.
5. Ask a teacher to find out the kwh used at your school for one month and divide by the number of persons regularly occupying the building.
6. Estimate the amount of kwh hours used in public places and businesses on your behalf by taking home use figure and multiplying it by 1/10.
7. Use the tables to convert all energy amounts to joules. What is the total number of joules used by yourself:
   a. in one month
   b. in one year
8. If 55% of your needs come from oil, 30% from gas, and 15% from coal, how many:
   a. barrels
   b. cubic feet and tons

   do you use in one year?





THE ORTEP-EATING SNARF

DOUBLING TIME

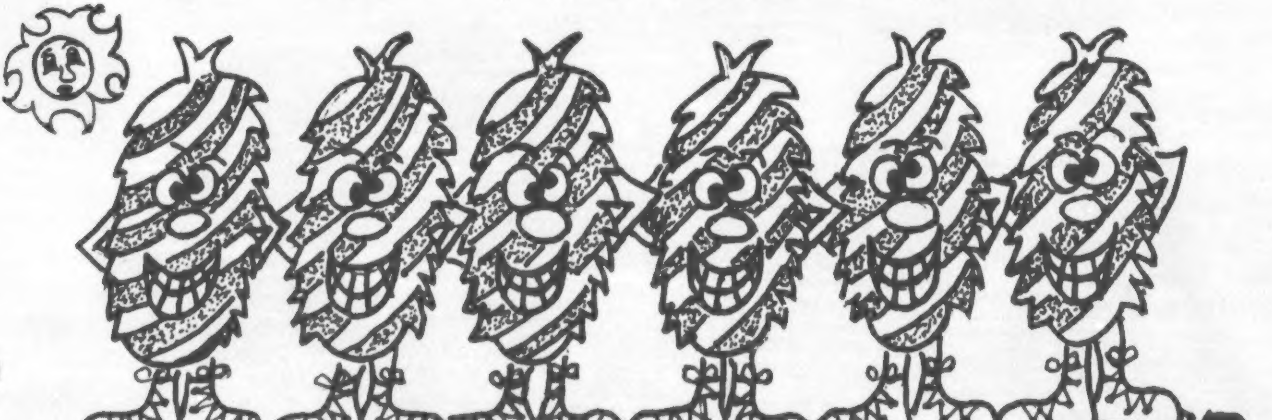
In order to explain doubling and its effect on a finite reserve, let me introduce the red-banded snarf.

Now, this ridiculous mythical beast reproduces very quickly. Under ideal conditions, a snarf can reproduce one every minute. In other words, the snarf's doubling time is one minute. Each and every minute, there are twice as many snarfs as there were the preceding minute.

Imagine that the snarf eats nothing but a rare material called ortep, which usually is quite hard to find. Now, suppose we were able to gather in one place all of the world's known reserves of ortep and place one snarf on this huge mountain of food at 11 a.m.

Because the snarf reproduces every minute, at 11:01 there would be two snarfs munching happily away on a seemingly endless supply of ortep. They could truly last hundreds of years at their present consumption rate. However, at 11:02 four snarfs are on ortep mountain. Note that the number is doubling with each passing minute and their need for food doubles also.

At 11:03, we count eight snarfs happily eating ortep and so on. But at 12:00, we can't believe our eyes!



The number of red-banded snarfs has grown tremendously and they have completely exhausted their food supply. How could this happen in only one hour? Let me give you a clue--one hour contains 60 doubling times.

Now, consider two questions:

(1) When was the ortep half gone?
(2) When would the normal, average-IQ, red-banded snarf first notice the danger of running out of ortep?

Well, at 11:39, (one minute before noon) one-half of the entire mountain of ortep was gone--or put another way, one-half of the known world's supply of ortep still remained. But the number of red-banded snarfs was in the process of doubling again so that their need for ortep also doubled. In the next minute, by 12:00 noon, they used the remaining one-half of the world's supply of ortep.

DOUBLING VERSUS "FANTASTIC NEW DISCOVERIES"

The answer to the second question is less clear. It's hard to tell when the average, reasonably alert, red-banded snarf would begin to worry. But let's imagine that they do something about their problem, and give the story a different ending. Let's look at the situation at 11:55. Maybe, at that time, one or two snarfs began to worry about the problem and tried to alert their neighbors--with no success. After all, at 11:55 only 3% of the ortep supply was gone, while 97% still remained. Who could possibly believe that there would be an ortep problem?

Finally, at 11:58, snarf leaders send out a team of very fast explorer-type snarfs to find more ortep. Now remember, the ortep is a nonrenewable resource just like coal, oil, and natural gas. The only hope lies in finding previously unknown reserves.

But joy is heaped on joy when, at 11:59, they return with good news. Fantastic new reserves of ortep have been found in Alaska and along the eastern shores of the United States. These new finds are equal to three times the entire previously known world's supply of ortep. How long will this new supply of ortep last?

The picture is just as grim as it was before. The new ortep will again melt in the face of ever-increasing demands of a growing ortep-hungry population. By 12:01, the snarfs will consume one mountain of ortep, an aount equal to all that has been consumed in the previous hour. In the next minute, by 12:02, they will consume the next two mountains of ortep and will again be facing starvation. With these fantastic new finds the snarfs have only held on to the "good life" for a matter of two more minutes--two doubling periods.

Here, we must make a very important point: EVEN FANTASTIC NEW DISCOVERIES ARE USED UP QUICKLY WHEN DOUBLING TAKES PLACE.

DOUBLING AND THE HISTORY OF A RESOURCE

Let's look back again at the snarf's consumption of ortep and assume that each snarf consumes one bite of ortep per minute.

Table 1 shows that at 11:00 there was only one snarf who consumed one bite of ortep. At 11:01, there were two snarfs eating two bites per minute, but the total taken from ortep mountain was three. At 11:02, there were four snarfs gobbling four bites per minute and the total removed from ortep mountain was seven. It is very easy to continue this table for as long as you like. However, let's take a closer look at it.

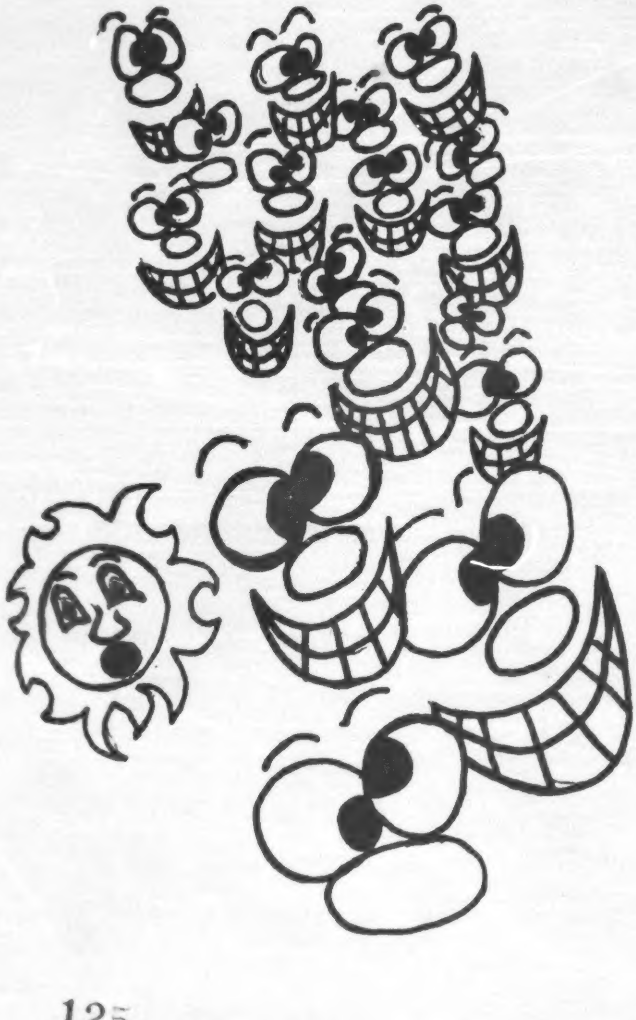


TABLE 1. PRINCIPLE OF DOUBLING OVER TIME

Time	No. of Snarfs	No. of Bites	Total No. of Bites
11:00	1	1	1
11:01	2	2	3
11:02	4	4	7
11:03	8	8	15
11:04	16	16	31

Between 11:01 and 11:02, there were four bites consumed, while in all previous history only three had been consumed. Between 11:02 and 11:03, eight bites were used, while only seven had been used in all previous history. Between 11:03 and 11:04, sixteen bites were devoured, compared to the 15 consumed in all previous history. THE SECOND IMPORTANT POINT ABOUT DOUBLING IS: IN ANY ONE DOUBLING PERIOD, MORE RESERVES ARE CONSUMED THAN IN ALL PRECEDING HISTORY.

The "doubling time" concept can be best understood by use of the formula $T_2 = \frac{70}{p}$; where T_2 equals the doubling time, 70 is a constant and p equals the percent of growth in a unit of time. In Seminole County the population growth during 1970-1980 was at a rate of 7%.

In the formula $T_2 = \frac{70}{7\%}$, T_2 = 10 years. This means that the population in Seminole county is doubled in 10 years.

Using the formula $T_2 = \frac{70}{P}$, where T represents the doubling time, 70 is a constant and P is the percent of growth in a unit of time. You will need to do some research in order to determine the % of growth for the years indicated (Check census report in Florida Statistical Abstracts).

Florida Counties	P = % of Growth	$\frac{70}{P}$	T_2: Doubling Time
Orange 1960-1970			
1970-1980			
Seminole 1960-1970			
1970-1980			
Dade 1970-1970			
1970-1980			
Duval 1960-1970			
1970-1980			
Hillsborough 1960-1970			
1970-1980			

1. Draw a bar graph or circle graph comparing the relative rates of growth for each county.
2. Rank the counties according to their growth in the last decade.
3. Give some reasons for the results in 2.

MORE QUESTIONS:

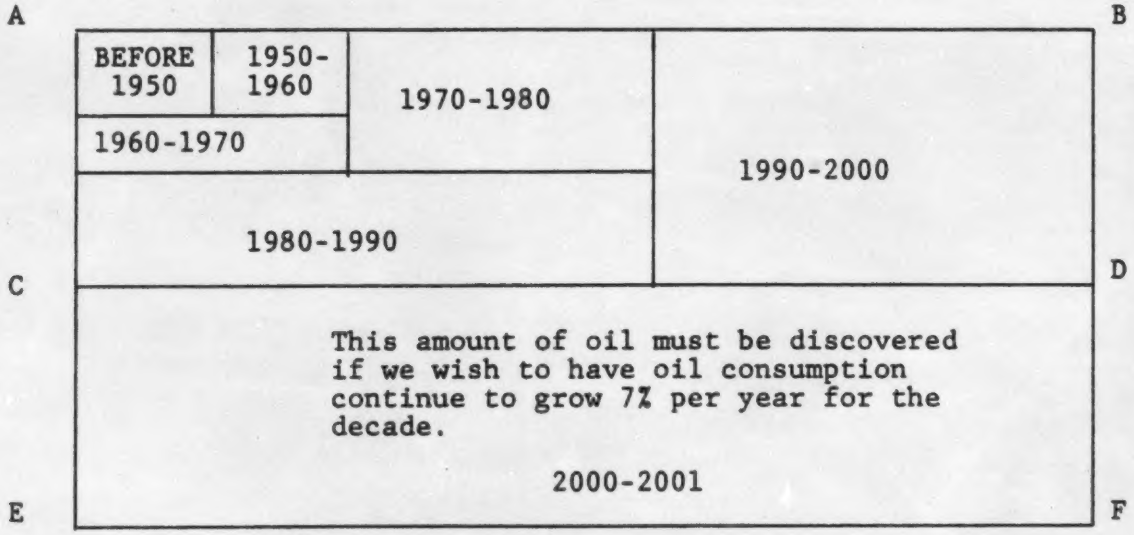
1. Using the doubling time results can you predict what effect this will have in the next ten years?

2. Discuss how this can effect the development of each county. Is there any reason why there is a major difference, if there is any?

3. What happens if the population doubles and agricultural production does not?

4. If the population growth in Seminole County continues at the present rate, what can you predict will happen in terms of school facilities, utilities, energy consumption, and energy resources.

5. How long can this growth continue? Have we reached the 11:59 time frame?

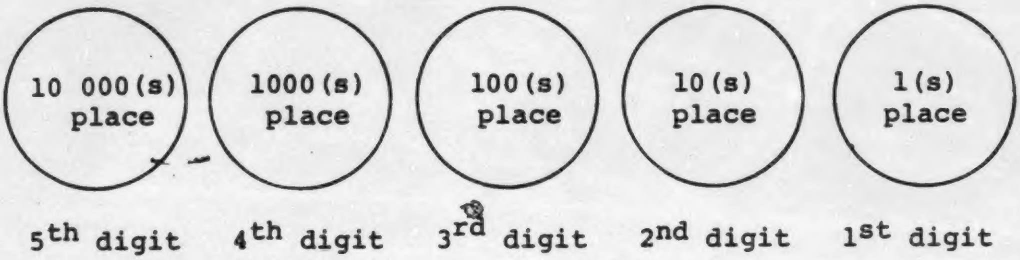


This amount of oil must be discovered if we wish to have oil consumption continue to grow 7% per year for the decade.

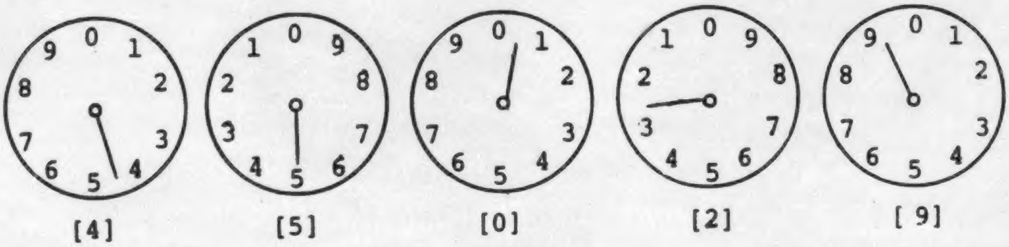
ELECTRIC METER - READER

The meter contains five dials, numbered from 0 to 10 and geared together. A special electric motor that speeds up or slows down as more or less electricity is being used turns the gears that operate the dials.

Starting from the left side the dials read values of 10,000, 1,000, 100, 10, and 1, as shown below.


10 000(s) place
1000(s) place
100(s) place
10(s) place
1(s) place
5th digit
4th digit
3rd digit
2nd digit
1st digit

The pointer on each dial will usually be between two numbers. Always take the lower of the two numbers. For example, look at the set of dials below:



THESE DIALS READ 45,029 KILOWATT-HOURS

ENERGY AWARENESS

I. Electric Bills

There are many ways to conserve energy in your home. The customer's bill for electricity is usually based on monthly meter readings.

Billy smith received this electric bill.

Current Service Period: 30 Days

Your Daily Use →

Kilowatt hour	Cost
14.1	$0.52

Rate	Service Dates From	Service Dates To	Meter Readings Present	Meter Readings Previous	Consumption Kilowatt hours Used	Amount	CODE
	06-30	07-30	6804	6381	423	$15.49	

Account Number					Address At Which Service Rendered	Date Mailed	Total Amount Due
H	12	3456	7890	12	700 Main St.,HV.	9-05-79	$15.49

ALABAMA ELECTRIC COMPANY

Problems

1. What is the amount of the bill?
2. How many days does the bill cover?
3. How many kilowatt hours were used?

NOTE:

1. This is how to find the daily use of kilowatt hours.

```
             14.1   daily use
days-- 30) 423.0   kilowatt hours used
           30
           123
           120
             30
             30
```

2. This is how to find the daily cost to the nearest cent.

```
               0.516  daily cost
days -- 30) $15.490  amount of bill
             15 0
                49
                30
               190
               180
```

II. Cost Of Operating Electrical Appliances

Have you ever wondered what it costs to operate a certain appliance in your home? For instance, what does your hair dryer cost in energy dollars every month? How about the dishwasher? The television set?

Well there is a way for you to make a rough estimate of the cost for operating each electric appliance. You must know three things: (1) the wattage of the appliance, (2) the approximate number of hours the appliance is used in a month, and (3) what you pay per kilowatt hour for electricity.

Check the wattage by looking at the appliance itself. Most new appliances have the wattage printed on them or on a metal label which is attached to the appliance. Sometimes it is shown in the instruction booklet. Now, figure as nearly as possible how many hours that appliance is used in a month. Multiply the wattage per appliance times the hours used in the month and then times the rate per kilowatt hour.

For example, if you have an appliance of 1500 watts that you use about 50 hours during the month simply multiply 1.5 times 50 times $.07 (the approximate cost per kilowatt hour in Tallahassee)and you can see that the appliance is costing you about $5.25 to operate each month.

It might be interesting for you to take the idea a step further and add up the estimated charges for most of the appliances in your home. Such an effort will certainly help your family be aware of how much energy you buy each month.

a. Find the number of kilowatts needed to operate each appliance.

Appliance	Watts	Kilowatts
Water Heater	2400	
Clothes Dryer	4850	
TV (Color)	300	
Washer	510	
Hair Dryer	1000	
Toothbrush	7	
Waterbed Heater	200	

b. The toothbrush is plugged in 24 hours a day to charge the battery. What is the cost to the nearest $0.001 for each time period? Electricity costs $0.04 per kilowatt hour.

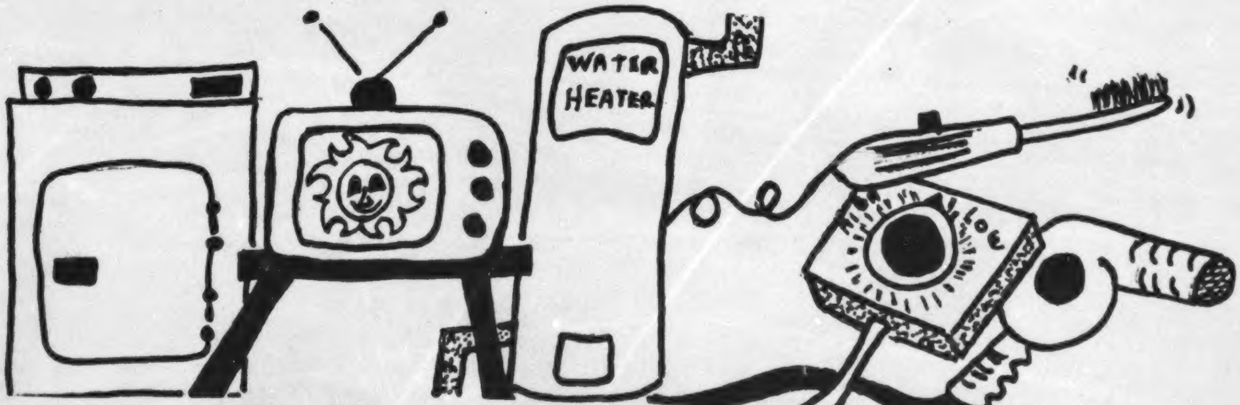
(1) One Day
(2) One Week
(3) One Year (365 days)

c. How many kilowatt hours are used daily by each appliance?

(1) Water Heater, 5 h
(2) Washer, 0.6 h
(3) TV, 6 h
(4) Clothes Dryer, 0.6 h
(5) Hair Dryer, 0.5 h
(6) Waterbed Heater, 24 h

d. Suppose one kilowatt hour costs $0.035. What is the cost to the nearest cent for operating each of the following appliances?

(1) Water Heater
(2) Washer
(3) TV
(4) Clothes Dryer
(5) Hair Dryer
(6) Waterbed Heater



ENERGY RESEARCH

1. Find out the relative efficiency of various systems used to generate, transform, and transport electricity. Take into account geographical region and available local resources such as a large river.

2. Calculate and explain the minium amount of energy in joules you would need for a comfortable existence.

3. Evaluate a purchase of a new home from an energy conservation point of view, i.e., cubic feet, insulation, storm windows, type of heating system, length of hot water lines, and square feet of the windows.

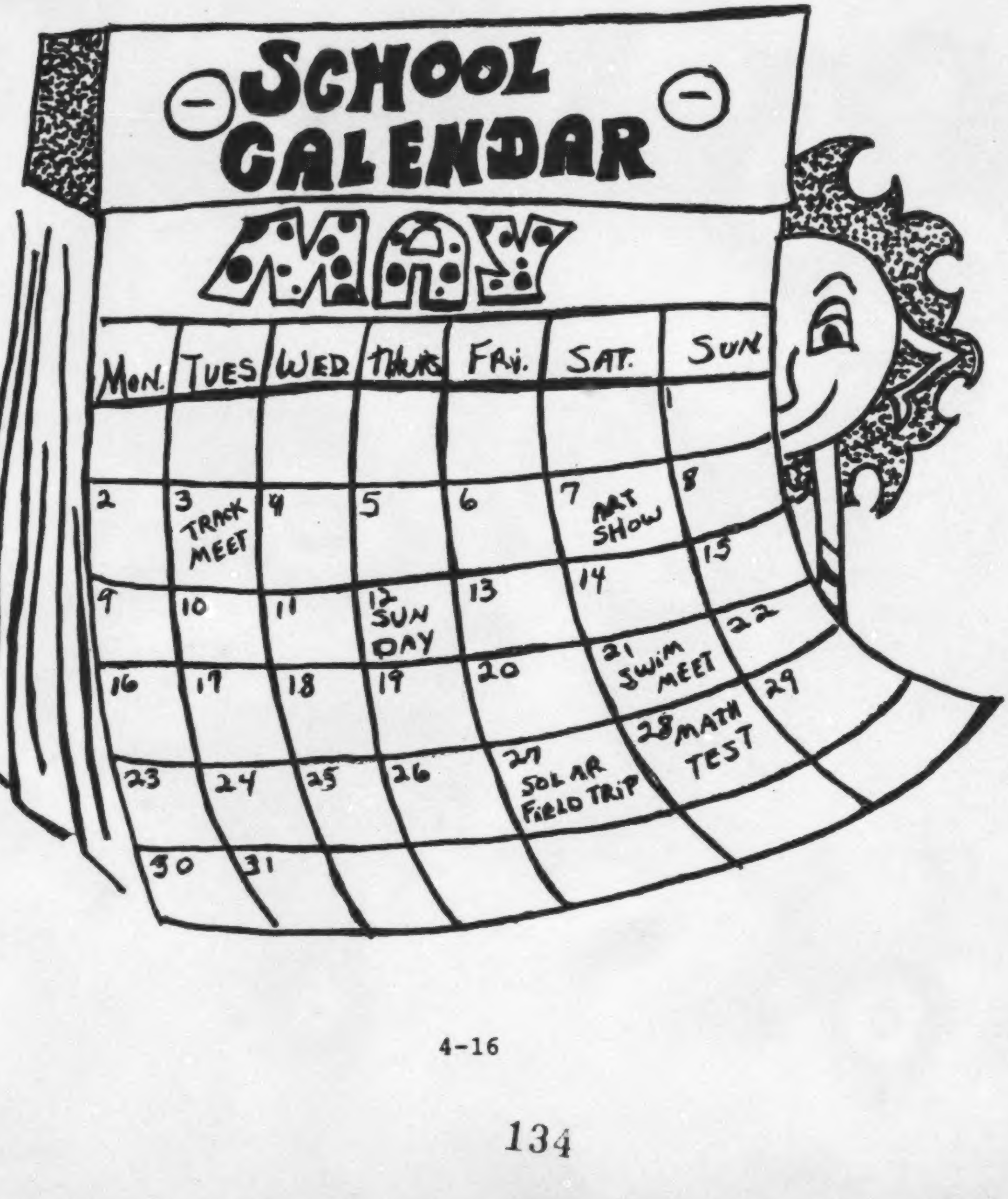
4. Prepare a school calendar with 180 school days which would minimize heating and air conditioning costs for your geographical region. Four day and six day weeks are allowed whenever they might be appropriate. You may need to consult the local meteorologists.

5. Calculate the percentage of the world's oil, coal and natural gas owned by the United States and what percentage of the world's output we actually use.

6. Make some observations at a drive-in window of a local bank. Record the number of cars per hour and how long, on the average each stays in an idle condition. Find out how much gasoline is used in an average car when it idles for one minute. Use this information to determine how much gasoline is wasted at drive-in window of that bank in one year.

8. Estimate the minimum amount of energy you would need for bare existence and give details to support your estimate.

9. Describe the relative efficiency of various systems used to generate, transform, and transport energy.


SCHOOL CALENDAR
MAY
MON.
TUES
WED
THURS
FRI.
SAT.
SUN
1
2
3 TRACK MEET
4
5
6
7 ART SHOW
8
9
10
11
12 SUN DAY
13
14
15
16
17
18
19
20
21 SWIM MEET
22
23
24
25
26
27 SOLAR FIELD TRIP
28 MATH TEST
29
30
31